NBER WORKING PAPER SERIES

CHRONIC SPECIE SCARCITY AND EFFICIENT BARTER: THE PROBLEM OF MAINTAINING AN OUTSIDE MONEY SUPPLY IN BRITISH COLONIAL AMERICA

Farley Grubb

Working Paper 18099
http://www.nber.org/papers/w18099

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
May 2012, Revised November 2018

Unedited draft; not for citation; to be included in Christine Desan, ed., Re-Theorizing Liquidity: Money, Credit, and Capital Dynamics (Philadelphia: University of Pennsylvania Press, forthcoming circa 2013). Preliminary versions were presented at the Third European Congress on World and Global History, London School of Economics, London, UK, 14-17 April 2011; The Institute for Global Law and Policy Pro-Seminar on Re-Theorizing Liquidity, Harvard Law School, Cambridge, MA, 6-9 June 2011 and 2 June 2012; and the Conference on "De-Teleologising History of Money and Its Theory," Japan Society for the Promotion of Science Research--Project 22330102, University of Tokyo, 14-16 February 2012. The author thanks the participants of these conferences and Christine Desan, Akinobu Kuroda, Ron Michener, and Angela Redish for helpful comments. Tracy McQueen provided editorial assistance. The views expressed herein are those of the author and do not necessarily reflect the views of the National Bureau of Economic Research.

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NBER Working Paper No. 18099
May 2012, Revised November 2018
JEL No. B12,B22,B31,D61,E41,E42,E51,E52,F11,F41,F54,N11,N21,N41

ABSTRACT

Colonial Americans complained that gold and silver coins (specie) were chronically scarce. These coins could be acquired only through importation. Given unrestricted trade in specie, market arbitrage should have eliminated chronic scarcity. A model of efficient barter and local inside money is developed to show how chronic specie scarcity in colonial America could prevail despite unrestricted specie-market arbitrage, thus justifying colonial complaints. The creation of inside paper monies by colonial governments was a welfare-enhancing response to preexisting chronic specie scarcity, not the cause of that scarcity.

Farley Grubb
University of Delaware
Economics Department
Newark, DE 19716
and NBER
grubbf@udel.edu

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Farley Grubb*

(11/2/18)

Colonial Americans complained that gold and silver coins (specie) were chronically scarce. These coins could be acquired only through importation. Given unrestricted trade in specie, market arbitrage should have eliminated chronic scarcity. A model of efficient barter and local inside money is developed to show how chronic specie scarcity in colonial America could prevail despite unrestricted specie-market arbitrage, thus justifying colonial complaints. The creation of inside paper monies by colonial governments was a welfare-enhancing response to preexisting chronic specie scarcity, not the cause of that scarcity.

INTRODUCTION

The Disagreement

Colonists in British North America complained that specie (gold and silver coins) for executing domestic transactions was scarce. Their complaints were ubiquitous and insistent.[1] Specie was the universal money—the outside money. It was the money the rest of the world used to consummate transactions that crossed polity borders, and it was the money often used by Europeans to consummate domestic transactions within their respective polities.[2] These colonies did not produce specie, as gold and silver were not yet mined there; besides the British Crown did not allow them to mint coins after 1688.[3] They acquired specie, mostly from Spanish America, in exchange for exported goods. Colonists complained that as quickly as specie was imported, it was re-exported, mostly to England, to buy imported goods. Contemporary accounts claimed that, in the absence of specie, domestic transactions were executed using barter, which was less efficient and more costly than using specie coins. Using barter reduced the quantity of domestic transactions thereby constraining economic development. Eventually, colonial assemblies issued paper monies to ameliorate the domestic effects of this chronic specie scarcity.

On the other hand, scholars have argued that chronic specie scarcity in colonial America

is a myth.[4] People always complain about not having enough money. Thus, ubiquitous complaints about a lack of specie do not mean that specie was scarce. The colonies were small open economies. If specie were needed to execute domestic transactions, more would be imported and less exported. Globally, specie flowed to where it was in short supply (more highly valued). Chronic specie scarcity, absent government intervention, was not possible. In 1752, David Hume summarized this position by stating, "Before the introduction of paper-money into our colonies, they had gold and silver sufficient for their circulation. Since the introduction of that commodity, the least inconveniency that has followed is the total banishment of the precious metals. And after the abolition of paper [money], can it be doubted but money [specie] will return..." (Rotwein 1970: 69).

Under the quantity theory of money in an open economy with an operative specie-flow mechanism, if specie is scarce domestically, then domestic prices will decline to accommodate the smaller money supply. As domestic prices fall, the locale's exports become more competitive abroad, and imports to the locale look less attractive relative to domestic goods. Exports increase which brings in more specie, and imports decrease which reduces specie outflow. This replenishes the locale's money supply to desired levels. As such, chronic specie scarcity cannot exist. Temporary specie scarcity is possible due to unexpected disruptions to the balance of trade, but market forces in an open economy will correct these imbalances. Ocean tides and storms exist, but sea level is sea level everywhere.

In this scenario, colonial complaints of specie scarcity were, in part, an outcome of currency substitution. When a colony emitted paper money with a fixed exchange rate to specie, that money displaced specie for use in domestic transactions. Specie scarcity occurred when enough paper money was produced to completely displace specie for executing domestic

transactions. In other words, the colonists themselves caused the specie scarcity of which they complained. If no paper money were emitted, specie would be plentiful enough to execute all domestic transactions.

While specie can be driven out by currency substitution, money *per se* is not made scarce by this mechanism. Being held in a fixed exchange rate with specie, paper money is a perfect substitute for specie. Domestic transactions do not resort to barter, and so chronic specie scarcity does not impact the real economy. As such, the colonists were misguided and their complaints of chronic specie scarcity should not be taken seriously. Either chronic specie scarcity did not exist or it did not matter.

What's at Stake in this Disagreement? The Larger Picture

While the specific focus here is on the British North American colonies, the general conditions and outcomes modeled below have broader applications. All economically underdeveloped and colonially constrained or economically dominated small polities face similar circumstances. As such, a large set of colonies and countries around the globe over the last several centuries fall within the modelling application here. The key features are: 1) The polity starts off underdeveloped in that many goods desired can only be cost-effectively acquired via imports. The ability to engage in import substitution via domestic production only comes later with sufficient internal economic development. 2) The polity cannot produce the money used by the outside world in global trade, i.e. the outside money, and so must export goods to acquire that outside money. 3) The polity is colonially constrained in their ability to use trade controls and other legal devices to prevent the imported outside money from flowing back out to buy the desired imported goods. As such, the ability to maintain an outside money as a local currency depends only on market conditions. 4) The polity is colonially constrained, but not absolutely

prevented, from developing domestic inside monies to aid in the execution of local trades when an outside money cannot be retained for that purpose.

These features also fit the vent-for-surplus characterization of colonization, whether total political colonization or just economic (domination) colonization, in that these colonies are export oriented. The exports are used to acquire foreign exchange to buy imports, with non-export domestic production left underdeveloped. Internal development and expanding domestic exchange are constraining problems with which these economies struggle. These features lead to the incentive within these polities to develop inside monies or ways to transact domestic trades without using an outside money. The variety, character, and effectiveness of inside monies, how inside and outside monies can co-exist without local government power to hold them in a fixed relationship, and how a nascent inside money supply can impact economic development, present a rich global history of puzzles that need better sorting out.

Finally, what is at stake here is a call to make economic theory more adaptable to historical circumstances. Economists must stop assuming away the problems of interest in these colonial economies just to make their cherished economic models work. The focus should not be on the model *per se*, but on the historical application. For example, the quantity theory of money and the specie-flow models of money and prices implicitly assume a developed economy, and not one as characterized by the colonial conditions described above. Such models assumes we know what money is and what money is not, and that all trades are monetized. Yet important aspects of colonial developing economies are degrees of monetization, alternative method of executing domestic transactions without money, and the creation of a variety of inside monies. Economists need to develop a more coherent and consistent answer to the question "What is money?" than what they currently have if they hope to fully address the fundament issues of

colonial economic development using the core tools of economic theory.

A DIGRESSION ON MONEY AND BARTER

Why is There Money?

When economists model an economy they start with the theory of value in a general equilibrium setting. The benchmark model in price theory is the Arrow-Debreu formalization of the Walrasian general equilibrium model. There is no money in this model. Goods trade for goods until their relative prices adjust, namely adjust in terms of what one good will trade for in terms of other goods, so that all markets clear thereby yielding a Pareto optimal outcome for society (Banerjee and Maskin 1996: 955-61, Starr 2012: viii-35). At best, there could be a *numeraire* good used to price all other goods in—a unit of account, but that good is in-determinant and so irrelevant in the system. The unit of account could even be a purely fictitious unit with no physical representation. All that matters is the matrix of relative prices, or trading ratios of goods to other goods. I call these prices the "barter price" for real goods.

This outcome challenges (or embarrasses) economists in terms of figuring out what role money plays and how to get money into the theory of value determination. Hence, economists constantly face the question, "Why is there money?" The benchmark Walrasian-Arrow-Debreu model has zero transaction costs to trade, i.e. zero search and information costs to trading. Thus, a standard approach to getting money into the Walrasian-Arrow-Debreu economy is to introduce frictions to trading, namely some type of transaction costs. Models involving overlapping generations, search and random matching in trades, cash-in-advance requirements, trading post structures, and so on all try to find a place for money in the Walrasian-Arrow-Debreu general equilibrium economy via trading constraints (Banerjee and Maskin 1996, Starr 2012).

Typically, these attempts assume money by imposing odd and ridged trading constraints,

or conflate money with whatever mediates an exchange thus making most anything money. Economist are so busy asking "why is there money?" that they forget to ask "what is money?" If we turn to the questions "what is money and what is not money?" and "what is barter and what is not barter?" economists lead us down a path to incoherence and useless definitions.

Economists tend to conflate money with whatever mediates an exchange, and barter with whatever does not mediate an exchange. Any good you trade for that you do not directly consume (Schumpeterian destruction consumption) but you, at some point, trade on to another person for a different good is considered a money. Any good that you trade for that you consume, and so cannot trade on, is considered a barter good. These considerations seem to be the most common definition of money and barter used by economists. The outcome is a broad definition of money and a narrow definition of barter, so broad and so narrow, respectively, that they are useless. They also lead to incoherent and inconsistent outcomes. (An aside for my economist friends: If barter only exists when there is destructive consumption post trade, does that mean that the existence of public goods entails omnipresent ethereal money?)

This common definition is also at odds with our original starting point, namely the Walrasian-Arrow-Debreu general equilibrium model. In that model real goods trade for real goods without money, and there is nothing in the model that says goods cannot transit across people before all markets clear. Real goods can mediate exchange without it being "money" unless you just willy-nilly conflate the two concepts. Doing so also raises the question—why talk about both the "medium of exchange" and "money" if they are the same thing? One concept can be dispensed with. But economists don't do that. Economist talk as if money and medium-of-exchange are different things, but then slide into conflating the two.

In most models trying to get money into a Walrasian-Arrow-Debreu general equilibrium

economy, economists are really focused on a common medium of exchange—a common carrier of value from individual to individual through time. In the process of trying to explain why a particular carrier of value becomes common, economist fall back into using eighteenth-century methodology, namely using unweighted categorization by characteristics, e.g. portability, divisibility, count-ability, durability, and so on, to explain the carrier chosen, and then call that carrier "money." The tools of economics are not used to define what money is.

The core problem is one of identity, namely the mixing of money and non-money value into one carrier of value that mediates an exchange, and then calling the whole thing "money." The money part of a thing must be separated from the non-money part of a thing to be able to talk coherently about money. By analogy—a sheep is a carrier of wool, but also a carrier of meat. If wool is the money part of the sheep and the meat is the real goods part, how do we talk about trading a sheep. Do we call the whole sheep money, or do we call the whole sheep barter? Ideally, we would want to measure the wool value part of the sheep only and call that the money or moneyness part, and reserve the meat value part for being just real barter goods value.

What is Money; What is Barter?

I propose an unconventional approach to defining money and barter, namely one that actually uses the tools of economics. First, what mediates an exchange is not necessarily money. While all monies mediate exchange not all things that mediate an exchange are monies. Real goods can mediate an exchange without being money, as in the pure Walrasian-Arrow-Debreu general equilibrium barter economy. Money is something different from just a mediator of exchange. Studying what is used most often as a medium of exchange is important, but it is not necessarily the same as studying what is money. The term "commodity money" is an oxymoron. The concept conflates money and medium of exchange just like in the sheep analogy above. We

study what mediates exchanges because money evolves out of that.

Second, I will define money and barter using the economist's tools of opportunity cost and counterfactual analysis. Money and barter will be defined in value term, rather than by the conventional method of using characteristic functionalities. Barter transactions are when real goods trade for real goods, immediately or ultimately (the time dimension does not matter here). If a real good is not used as money, what would its value or barter price be in a pure Walrasian-Arrow-Debreu general equilibrium. If that counterfactual barter price is the same as the price we observe, then there is no money component in the good, namely it is a pure barter good—the sheep's value is only its meat value. The wool provides no extra value. This determination uses counterfactual analysis.

Money, then, is something you are willing to pay for, an extra value you are willing to give for a thing, because that thing—the carrier of value—is more convenient to use to execute future transactions than the next best alternative thing. Money is a transaction premium. In the sheep analogy, how much are you willing to pay for the sheep over its pure meat value, namely for the addition of the wool? That extra value is the money part of the sheep, or what I call the "moneyness" value. The wool is not the money. It is the value you are willing to pay for that aspect of the sheep compared with the next best alternative. Thus, money is really a "moneyness" value concept rather than a "thing" object. Media of exchange may be part real goods value and part transacting convenience value. We need to separate the two to coherently talk about money versus barter (Grubb 2016a, 2016b, 2018, 2019).

The study of the rise of money, or the endogenous creation of monies, especially inside monies, becomes an organic evolutionary exercise under these definitions. How things that mediate exchange begin to take on moneyness value beyond their pure barter goods value

becomes the interesting question to study—until ultimately we end up with pure fiat monies, namely things that are all moneyness value with no real barter goods value to them. What governments designate a legal tender, what arises as a common unit of account in society, and so on, are not money *per se*. They can, however, contribute in varying degrees to appending some moneyness value onto an otherwise real barter good that is being used as a carrier of value.

Because barter is defined here broadly, I will have gradients of barter structures related to levels of transacting costs, namely *crude barter* with the highest transacting costs, *efficient barter* which somewhat economizes on transacting costs, and *enhanced efficient barter* which substantially economizes on transacting costs. These gradients of barter or evolving barter structures linked to transacting cost economization still involve real goods trading for real goods, and do not necessarily encompass monetary transactions as defined here. This transaction-cost-economizing evolution in barter structures, however, creates the conditions for the rise of a transaction premium appended to barter good exchanges. As such it captures the beginning of an emergence of an endogenous money—the creation of a moneyness value.

A Simple Heuristic Exercise to Illustrate the Issues and Problems: The Economy of Fruitopia[5]

The following is a simple set of heuristic trading models used to illustrate the problems and issues of defining money and barter discussed above. I stripped the models down for the nontechnical reader. For example, I purposefully kept the relative pricing simple. This heuristic exercise is also used to aid in understanding the concepts modeled later in the paper for the British American colonies.

I. Four-Person Trade-Economy 1: With No Information or Transaction Costs

Have:	banana	apple	pear	plum
Persons:	*Sally*	*Ted*	*Bill*	*Zoe*
Want:	apple	pear	plum	banana

A. Suppose trade can only happen when there exists a double coincidence of wants between two people, what I term *crude barter* (cb) in Figures 3 and 4 below. Given what people have versus what they want in the above economy, no double coincidence of wants exists and so no domestic trades take place. This economy is stuck in autarky, namely "Y autarky" in Figures 3 through 6 below. Everyone must consume what they started with as their "haves." This is not a Pareto optimal Walrasian general equilibrium outcome.

B. Suppose now there are no information and transaction costs. Then everyone can end up with what they want by trading away what they have. For example, *Sally* trades her banana to *Ted* for *Ted's* apple. *Sally* now has what she wants. *Ted* then trades his newly acquired banana to *Bill* for *Bill's* pear. *Ted* now has what he wants. *Bill* then trades his newly acquired banana to *Zoe* for *Zoe's* plum. *Bill* now has what he wants and *Zoe* now has what she wants. This is a Pareto optimal Walrasian general equilibrium with no money. It is all barter trades, i.e. real goods traded for real goods (by my definition of barter).

Now suppose instead we define money as anything that mediates an exchange, i.e. a thing that passes through your hands in trade that you do not directly consume but is traded on. Suppose we define barter as anything taken in trade but then not traded on (being instead consumed). This is the most commonly used definition of money and barter in economics. Under this common definition, in the above economy, money is an inconsistent and incoherent concept. In the above action, the banana is "money" to *Ted* and *Bill*, but not money to *Sally* and *Zoe* (being instead barter goods for these two). The apple, pear, and plum are not money, but barter goods.

This conclusion is also random, and so again leads to an incoherent and inconsistent definition of money and barter. The same Pareto optimal Walrasian general equilibrium can be

achieved starting with *Ted* trading his apple to *Bill* for the pear *Ted* wants; *Bill* trading the apple on to *Zoe* for the plum *Bill* wants; *Zoe* trading the apple on to *Sally* for the banana *Zoe* wants. Everyone ends up with what they want, but now the apple is "money" for *Bill* and *Zoe* but not for *Ted* and *Sally* (being barter goods for these two). The banana, pear, and plum are not money, but barter goods. The same scenario and end outcome can be achieved by starting with the pear or by stating with the plum as the good that changes hands the most. What is money and what is barter becomes randomly situational here, thus inconsistent and incoherent, which is unsatisfactory for what we want money and barter to be.

II. Four-Person Trade-Economy 2: Prohibitive Transaction Costs to Non-Adjacent Trades

Have:	banana	apple	pear	plum
Persons:	*Sally*	*Ted*	*Bill*	*Zoe*
Want:	pear	plum	banana	apple

A. Suppose trade can only happen when there exists a double coincidence of wants between two people, i.e. *crude barter*, and there are substantial information and transaction costs to finding a trade-match with non-adjacent consumers. If *Ted* and *Zoe* just happen to find each other (a random accident), they trade and end up with what they want. If *Sally* and *Bill* cannot find each other, no trade takes place. This is not a Pareto optimal Walrasian general equilibrium. This outcome corresponds to the "X" point using TC_{cb} (transaction costs under *crude barter*) in Figures 3 and 4 below. There is no money here. Real goods trade for real goods, namely an apple trades for a plum, nothing more (by my definition of barter).

B. Suppose that adjacent consumers experience much lower information and transactions costs than for non-adjacent consumers, with a wrap around in the model so that *Zoe* and *Sally* are considered adjacent. Then a Pareto optimal Walrasian general equilibrium outcome can be achieved. *Ted* trades his apple to *Sally* for her banana. *Bill* trades his pear to *Zoe* for her plum.

Zoe then trades the pear on to *Sally* for the apple *Sally* acquired from *Ted*. *Bill* then trades the plum he acquired from *Zoe* on to *Ted* for *Ted's* banana he acquired from *Sally*. Everyone now has what they want.

Now again, suppose we define money as anything that mediates an exchange, i.e. a thing that passes through your hands in trade that you do not directly consume but is traded on. Suppose we define barter as anything taken in trade but then is not traded on (being instead consumed by you). Under this common definition, in the above economy, money is an inconsistent and incoherent concept. In the above action, the banana is "money" to *Ted* but not money to *Sally*, *Bill*, and *Zoe*. The pear is "money" to *Zoe* but not to *Sally*, *Ted*, and *Bill*. The plum is "money" to *Bill* but not to *Zoe*, *Sally*, and *Ted*. The apple is "money" to *Sally* but not to *Ted*, *Bill*, and *Zoe*. The pear is a barter good to *Sally*; the plum is a barter good to *Ted*; the banana is a barter good to *Bill*; and the apple is a barter to *Zoe*; but not to the other consumers in the economy. Again, what is money and what is barter becomes randomly situational here, thus inconsistent and incoherent, which is unsatisfactory for what we want money and barter to be.

The outcome in **II.B.** expands transactions and trade gains from that in **II.A**. It corresponds to what I term *efficient barter* (TC_{eb}) in Figures 5, to distinguish it from *crude barter* in part **A**. I term it barter because real goods are trading for real goods, nothing more. We get away from the inconsistent and incoherent common definition of money and barter by terming barter as any trade where real good are exchanged for real goods regardless of whether it is consumed or passed on. If it is passed on, then it simply serves to mediate subsequent exchange (a medium of exchange). Money mediates exchange, but so can real goods. Money must be something different, or more, than just a mediator of exchange.

C. Walrasian general equilibrium is not thought about typically as an outcome of a set of sequential trades as in part **B** above. Suppose *Sally*, *Ted*, *Bill*, and *Zoe* all have access to a common site, say a local store overseen by a central scrutinizer (the Walrasian auctioneer) or just a storekeeper. All four bring their haves to the store, place then there and pick out what they want and go home. This is a Pareto optimal Walrasian general equilibrium. It achieves the same outcome regardless of whether the initial arrangement of fruit haves and wants are that of **I** or **II**. Everyone gets what they want, all trades take place, there is no money used, and all are barter exchanges. This also falls under what I term *efficient barter* (TC_{eb}) in Figure 5 below, to distinguish it from *crude barter* in **II.A.** and (TC_{cb}) in Figure 3 and 4 below.

The equilibrium in **II.C.** is perfect market clearing using no money, just pure barter. Walrasian (barter) pricing is in a unit of account, the *numeraire*, selected from among the goods. Barter pricing is pure relative pricing, as such, which good is chosen as the unit of account, or even choosing a fictitious unit of account with no physical representation (a Fizbin), does not matter. It is non-determinant. When I talk about *barter prices*, I am referring to this set of market clearing relative prices in a Walrasian general equilibrium expressed in one of the units of account created to evaluate relative prices among goods. In the simple example here:

The banana price:	The plum price:	The pear price:	The Fizbin price:	And so on
of an apple = 1	of an apple = 1	of an apple = 1	of an apple = 1	
of a pear = 1	of a pear = 1	of a plum = 1	of a pear = 1	
of a plum = 1	of a banana = 1	of a banana = 1	of a plum = 1	
			of a banana = 1	

The time dimension of trades also does not matter here. Trades can be non-synchronized in time and thus exhibit a credit-debit exchange structure, but such is still barter. Such is just part of the evolution to more efficient barter structures that reduce transaction costs. *Sally* could leave her banana at the store and return home, i.e. incur a banana credit. Then *Ted* could show up at the

store a day later, take the banana, thus incurring a banana debit. Then the next week *Ted* returns to leave his apple so clearing his banana debit. Then *Sally* finally returns to the store the day after and claims the apple thus extinguishing her banana credit. As long as the value of time *per se*, i.e. time discounting, is zero, the time lags are irrelevant to the Pareto Walrasian general equilibrium outcome here. The trades are still just real goods exchanged for real goods and so barter transactions as I define it. If time has value *per se* and/or goods depreciate with time, then some relative price adjustment to the trade of goods will take place to maintain the Walrasian general equilibrium outcome, but that is just a set of barter price (relative price) adjustments. A credit-debit exchange structure is still just a barter type transactions set. To get beyond this, transaction and information costs must be added to the trading model.

III. Four-Person Trade-Economy 3: With Explicit and Variable Transaction Costs

Have:	grapes	grapes	grapes	grapes
	banana	apple	pear	plum
Persons:	*Sally*	*Ted*	*Bill*	*Zoe*
Want:	apple	pear	plum	banana
	grapes	grapes	grapes	grapes

A. Suppose everyone has bunches of grapes and individual grapes are less valuable than the other fruits each desires. In addition, suppose each time you trade a non-grape fruit two of your grapes are trampled and lost. This is the transaction cost (value lost) in the act of trading a non-grape fruit. We end with the same outcome as in **I.B.** and **II.C.**, everyone gets what they want and it is a Pareto optimal Walrasian general equilibrium. The set of relative (barter) prices are the same as in **II.C**. It is just now the traders at the end of the trade sequence (*Sally* and *Zoe*) each lose two grapes, and the traders in the middle of the sequence (*Ted* and *Bill*) each lose four grapes. The total welfare loss in this economy after trading to get what everyone wants compared with a case of no transaction costs to trade is 12 grapes. The total welfare loss is the same no

matter which fruit starts the trading process. This corresponds to the limited welfare gain in Figures 3 and 4 under TC_{cb}, namely the limited size of the area A in Figures 3 and 4. The only difference resulting from which fruit starts the trading process is who suffers the two versus four grape transaction cost loss, namely who is at the ends of the trading sequence.

B. Suppose that people discover how to trade the banana while only trampling one grape, but not how to trade the other non-grape fruits without trampling two grapes. They figure out a more efficient barter method, corresponding to TC_{eb} in Figure 5. Unlike in **I.B.** where it did not matter which fruit was used to mediate three of the trades, now it does matter. The banana is the lowest transaction cost object and so will become the predominant mediator of exchange.

Ted knows that he will lose two grapes in the process of trading his apple to *Sally* for her banana. But *Ted* also knows that when he trades the banana on to *Bill* to get *Bill's* pear that he will only lose one grape trampled. *Ted* will now only lose three grapes as opposed to four grapes of transaction cost under **III.A**. Similarly, *Bill* knows that he will lose two grapes in the process of trading his pear to *Ted* for *Ted's* banana. But *Bill* also knows that when he trades the banana on to *Zoe* to get *Zoe's* plum that he will only lose one grape trampled. *Bill* now only loses three grapes as opposed to four grapes of transaction costs under **III.A**. *Zoe* loses two grapes, as before, when she trades her plum to *Bill*. *Sally*, being the initial person in possession of the object with the lower transaction cost in trade, loses only one grape when she trades her banana for *Ted's* apple that she desires. The total transactions cost for the economy is now only nine grapes trampled as opposed to 12 in **III.A**.

Unlike in **I.B.** where it did not matter which fruit was used to mediate three of the trades, now it does matter. For example, if the apples was used as the main mediator of trade, i.e. starting with *Ted* trading his apple for the pear, then *Bill* trading the apple on for the plum, then

Zoe trading the plum on to *Sally* for the banana so that all now have what they want, the total loss of trampled grapes would be 11. Using either the apple, pear, or plum as the prime mediator of exchange each leads to 11 grapes trampled, whereas using the banana as the prime mediator of exchange leads to only nine grapes trampled. The banana is the lowest transaction cost object and so will become the chosen mediator of exchange because it leads to enhanced general welfare. This outcome corresponds to the expanded size of area A in Figure 5 over that in Figure 4 (A for TC_{eb} > A for TC_{cb}).

So how does society make sure the banana is the mediator of exchange and not one of the other fruits? This is where the role of "money" as I define comes in. Money is not the mediator of exchange—it is not the banana. The banana is a real good whose relative value or barter price is 1, see **II.C**. Money is the convenience value of using the banana, its lower transaction cost, compared with using the next best alternative mediator of exchange (one of the other fruits). That value is what I call the "moneyness" or "transaction premium" value of the banana (Grubb 2016a, 2016b, 2018, 2019). "Money" here is a value measure, namely its opportunity cost as a transacting medium. It comes from what people are willing to pay to use the banana instead of the next best alternative as a mediator of exchange, namely using one of the other non-grape fruits as the primary mediator of exchange.

Ted gains a grape by using the banana as the pass through mediator of exchange over using the apple to trade for the pear as the initial trade making the apple the pass through mediator of exchange. So *Ted* is willing to pay to *Sally* $0 \geq \text{grape} \leq 1$ to trade the apple for her banana. That dominates any other trade and so starts the process. Similarly, *Bill* gains a grape by using the banana as the pass through mediator of exchange over using the pear to trade for the plum as the initial trade making the pear the pass through mediator of exchange. So *Bill* is

willing to pay to *Ted* 0 ≥ grape ≤ 1 to trade the pear for his banana. The "moneyness" portion of the banana exchange as the mediator of exchange as it passes through *Ted's* and then *Bill's* hands is some portion of a grape. Money is not a grape *per se*, not the thing, but that extra *value* paid by *Ted* and then by *Bill* for the transacting convenience, i.e. lowered transaction cost, of using the banana as opposed to any other fruit as the pass through mediator of exchange. Because *Ted*, and then *Bill*, are willing to pay this add transaction premium to the banana, it selects the banana rather than any other fruit as the primary mediator of exchange in the sequence of trades that yields the Pareto optimal Walrasian general equilibrium outcome (where everyone ends up with what they want). *Sally* is a net gainer of 0 ≥ grape ≤ 1 being the initial possessor of the object with the most "moneyness" value—in essence she is the "money" creator here.

C. Suppose instead of sequential trades there is a Walrasian central store exchange system as in **II.C.**, but with some transaction costs to getting goods to and from the store. Suppose one grape is trampled going to the store and one grape is trampled coming from the store, for a loss of two grapes per person or eight grapes of transaction cost for society per trade cycle. If the store's central scrutinizer extracts a total of one grape for the store services per trade cycle, that would leave a total transaction cost to society of nine grapes per trade cycle. This outcome would be comparable to, or slightly lower in transaction costs, than the barter structure in **II.B**. Thus, I also include this store-exchange structure within the *efficient barter* group.

IV. Four-Person Trade-Economy 4: Transaction Costs with an Outside Money

Have:	grapes banana coin	grapes apple	grapes pear	grapes plum
Persons:	*Sally*	*Ted*	*Bill*	*Zoe*
Want:	apple grapes	pear kiwi grapes	plum grapes	banana grapes

A. Suppose *Sally* has a foreign coin she found on a dead pirate. This is a coin used by the world outside this economy to transact all trades, and magically when you trade with it in this economy no grapes are trampled on the coin side and only $1/4^{th}$ of a grape is trampled on the goods side of the transaction. Everything else is as before in **III.B**. As such, the transaction cost of using the coin as the mediator of exchange is nearer to zero than using the banana from **III.B**. Using the coin reduces the total transaction-cost loss to one grape versus nine grapes when using the next best alternative, namely the banana as the primary mediator of exchange in **III. B**.

Sally trades the coin to *Ted* for *Ted's* apple; *Ted* trades the coin on to *Bill* for *Bill's* pear; *Bill* trades the coin on to *Zoe* for *Zoe's* plum; *Zoe* trades the coin on to *Sally* for *Sally's* banana. Everyone ends up with what they desire and the coin is back with *Sally* and so can be used for the next time period replication of trade. In this one trade-sequence iteration, *Ted*, *Bill*, *Zoe*, and *Sally* each lose $1/4^{th}$ of a grape for a total lost to society of only one grape. *Sally* suffers $1/4^{th}$ grape loss in trade versus one grape loss when starting the trade sequence with the banana in **III. B**. She could potentially extract $0 \geq$ grape ≤ 7.25 from the others as the money creator or the person induced to start the process of using the coin in trade. This is a Pareto optimal Walrasian general equilibrium outcome. Note: The relative barter prices from **II.C.** have not changed. This outcome corresponds to the TC_{sm} point "Z" in Figures 3 through 6 below. For *Ted* and *Bill*, the coin has a "moneyness" value of 2.75 grapes each; for *Zoe* 1.75 grapes, and for *Sally* 0.75 grapes over using the next best alternative, i.e. the banana as the primary mediator of exchange. For the society as a whole, the coin has a "moneyness" value of eight grapes per completed trade cycle over the next best mediator alternative, i.e. using the banana.

B. The above **IV.A.** assumes a closed economy. Now suppose we have an open economy. *Ted* desires a kiwi that can only be acquired from outside the economy and must be paid for in

the outside money coin. *Ted* desires the kiwi more than the pear. We start the trading process as in **IV.A.** with *Sally* trading her coin to *Ted* for *Ted's* apple. *Sally* has what she wants. *Ted*, instead of the trading the coin to *Bill* for *Bill's* pear, comes out ahead by exporting the coin to acquire the kiwi. *Ted* now has what he wants most, and the coin has exited the economy. *Bill* and *Zoe* are stuck. They cannot trade for what they most want. *Zoe* could offer the plum to *Sally* for *Sally's* banana, but then if *Sally* does not value the plum over the banana or via trading the plum to *Bill* for *Bill's* pear, and values the pear over the banana, no trades will happen.

If *Ted* really really values the kiwi over pear, there is no combination of value that *Bill* and *Zoe* can offer to *Ted* to induce him to not use the coin to buy the kiwi. The opportunity cost to *Ted* of not using the coin to buy the kiwi dominates the other potential trades in the economy. This outcome corresponds to $(TC + OC)_{sm}$ point "W" in Figures 4 through 6 below.

Ted causes the coin to exit the society and there is no way to bring it back. The trading system and total welfare outside of *Ted's* welfare is reduced. *Ted's* utility maximizing choice leads to reduced social welfare and so induces the society to develop some alternative inside mediator of exchange like the coin, but one that cannot be exported for anything.

V. Four-Person Trade-Economy 5: Transaction Costs with an Inside Money

Have:	grapes	grapes	grapes	grapes
	banana	apple	pear	plum
Persons:	*Sally*	*Ted*	*Bill*	*Zoe*
Want:	apple	pear	plum	banana
	grapes	grapes	grapes	grapes

A. Suppose the coin has already exited this economy and trade has reverted to a trade cycle with the banana as the primary mediator of exchange as in **III.B**. Suppose the local government or central scrutinizer recognizes the transaction-cost gains of using a coin-like medium of exchange and also the welfare loss of not being able to prevent the coin from exiting

the economy, and wants to try to replicate the gains without suffering the welfare loss. In short, they want to create a coin-like medium of exchange that is superior to the banana as a mediator of exchange but also cannot be exported for any value, i.e. a pure inside "money."

Suppose the local government creates a [1 Fruit paper bill] and loans it to *Bill* for the trade cycle with *Bill* pledging his pear and two grapes as collateral for the loan and agreeing to pay the local government one grape in interest for the loan with the principal when due at the end of the trade cycle. The government makes the Fruit paper bill a legal tender in that the loan principal must be repaid in that bill. Suppose also, like the coin, the Fruit bill causes no grapes to be trampled when offered in trade on the bill side, and only one grape to be trampled on the goods side of the transaction. Because of the structure of the Fruit bill emission and redemption, others in the economy see it as a lower transaction cost way to trade than using the banana, though not as low as using an outside coin. I refer to this structure as *enhanced efficient barter* or TC_{eeb} in Figure 6 below. It is barter because the Fruit bill is really a mortgaged claim to a real good—the pear, and so real goods are trading for read goods. But it will serve as a medium of exchange whereby it will take on some "moneyness" value in excess of its real goods value.

Bill trades the Fruit bill to *Zoe* for *Zoe's* plum; *Zoe* trades the Fruit bill on to *Sally* for *Sally's* banana; *Sally* trades the Fruit bill on to *Ted* for *Ted's* apple; *Ted* trades the Fruit bill back to *Bill* for *Bill's* pear; and then *Bill* pays the government the Fruit bill plus one grade in interest to extinguish his original loan. This sequence can be repeated every trade cycle. Everyone ends up with what they want at the end of the trade cycle and so it is a Pareto optimal Walrasian general equilibrium.

The total transaction costs incurred for the whole society for one trade cycle is five grapes. Each person loses one grape trampled when trading their real good for the Fruit bill, plus

Bill loses one grape in interest paid to the government (and the government wastes the grape on politician frivolities). The total transactions cost are lower than the nine trampled grapes lost when using the banana as the primary mediator of local trades in **III.B**. This is why I term such a governmental inside money creation *enhance efficient barter* to distinguish from the commodity money like (the **III.B.** banana) or store-account clearing (**III.C.**) *efficient barter*.

The Fruit bill has some "moneyness" attached to it. Its barter or real goods value is one non-grape fruit. It, however, has extra convenience value in trade that people are willing to pay for. This is its moneyness value. Compared with using a banana as the next best alternative as in **III.B.**, that extra value for each person is one grape. *Bill* is willing to pay a grape in interest for its use. Each person would be willing to pay $0 \leq \text{grape} \leq 1$ over and above their non-grape fruit to trade with a partner offering a 1 Fruit bill as opposed offering a banana in trade.

The total transaction costs of using the Fruit bill are not as low as using the outside money coin when there is no opportunity cost to exporting the coin, namely when you can retain the coin for executing future local trades. This corresponds to $TC_{eeb} > TC_{sm}$ Figure 6 below. The total transaction costs of using the inside money, however, is less than the total transactions cost plus opportunity cost of using the outside money (the coin) when the coin cannot be prevented from being exported for something that cannot be cost effectively substituted in its place from the local economy, see **IV.B**. This corresponds to $TC_{eeb} < (TC + OC)_{sm}$ in Figure 6 below.

These simple heuristic trading models illustrate what is developed below for the evolution of British colonial American polities with regard to using outside money, inside money, and barter exchange. I realize that my broad definition of barter exchange and narrow definition of money, or moneyness, compared with what is codified in the general literature and in public usage, will not likely be adopted as the new common understanding, but that does not

mean that it is conceptually valueless. I liken it to the problem economists have when talking about profits and how profits are used and measured in economic models. The non-economists, the general public, students, and so on, all think about profits in simple accounting terms. Economists include opportunity cost when accessing profits, not just accounting outlays. We economists can talk until we are blue in the face, and blue in the face over centuries, stressing that economic profits are not the same as accounting profits and that economic profits are a superior measure for explaining behavioral choices, but we will never get the general public or any non-economists to adopt our definition of profits. I view defining money to be coherently and consistently measured using the economist's tool of opportunity cost and counterfactual measurement to be valuable, but hopeless for changing the language of the masses. We are likely doomed to money being defined in the general literature in a chaotic, messy, incoherent, and inconsistent way. Such may be the fate of all fruitful analysis.

APPLICATION TO THE BRITISH NORTH AMERICAN COLONIAL ECONOMIES

Modeling the Disagreement over Specie (Outside Money) Scarcity

For a small open economy that does not produce its own specie or paper money, and engages in no foreign trade and specie-money-supply controls, under what conditions is chronic specie scarcity for executing domestic transactions possible? In other words, under what conditions will imported specie be immediately exported to pay for more imported goods rather than retained for executing domestic transactions?

If credence is given to the colonial writers who assert that specie was chronically scarce, then there must be an explanation for the failure of the equilibrating effect predicted by the quantity theory of money, specie-flow mechanism. The model developed here provides that explanation by relaxing two implicit assumptions embedded in that theory's characterization of

the colonial economy, namely the assumptions that all goods are tradable goods and that all transactions are monetized. Instead, the colonial economy will be assumed to produce and consume both tradable and non-tradable goods, e.g. tobacco and horse racing, respectively. Only some goods can be exported for specie (tobacco, flour, rice), and only some goods can be obtained through imports bought with specie (tea, sugar, Madeira wine). These imports are assumed to have no domestically produced near-substitutes (Lester 1938: 329). Finally, many domestic goods cannot be cost-effectively exported nor can imports be cost-effectively substituted in their place, e.g. hay, firewood, and horse racing. These goods are produced and traded only within the domestic economy (Davis 1964, 1: 353; 3: 376-78). I will call these goods "non-tradable" in the sense that they are not traded outside the domestic economy, either directly or in the form of a close substitute good, due to their relatively high transaction trade costs.

In addition, it will be assumed that colonial economies engage in both monetized and non-monetized transactions. Barter with varying degrees of transaction-cost efficiency can be used to execute domestic transactions. This assumption makes using the simple quantity theory of money within a specie-flow mechanism problematic. Barter alternatives put a price floor under which the specie price of non-tradable goods cannot fall. If all specie leaves the economy then, under the quantity theory of money, prices must be bid down to zero. This cannot happen when barter has some efficiency in executing domestic transactions.

Export and import prices are set in world markets and do not respond to local specie scarcity. When specie in a colony becomes scarce, specie prices for domestic transactions of non-tradable goods fall toward their barter price alternative. The relative price of that colony's non-tradable to tradable goods falls, but only so far—the fall constrained by the barter price floor. Therefore, as long as the elasticity of substitution between non-tradable and tradable goods

is low, the consumption of the two types of goods will not change enough to overcome the lack of specie for transacting domestic non-tradable goods. The specie price of non-tradable goods can only fall to its barter price alternative, which is not low enough to draw specie into executing domestic transactions instead of buying imports. That is, domestic goods will be exchanged by barter at a specie-stated price, leaving existing specie to be used to buy imported goods. The fall in the specie price of non-tradable goods, compared with tradable goods, pushes the colonists toward export goods production, i.e. the staples or vent-for-surplus thesis, with the specie earned from exports being immediately re-exported to purchase imports (Labaree, Oberg, and Willcox 1959, 1: 144-45; Lester 1939: 210, 212; McCusker and Menard 1985: 17-34). Increased specie "pass-through," keeping specie scarce for executing domestic transactions, results.

Taking the Colonists Seriously

The modeling that follows is an exercise in taking colonial complaints about chronic specie scarcity seriously. Benjamin Franklin will be used to illustrate this colonial position. He makes an excellent representative because he holds the two positions in question, namely that 1) specie was chronically scarce, and 2) this scarcity pre-dates the issuance of paper monies by colonial assemblies. Franklin was recognized as the preeminent American of his generation in science, statesmanship, and letters. He wrote pamphlets, treaties, and correspondences on paper money. He designed and printed paper money for various colonies. As an assemblyman for Pennsylvania he was involved in the debates over, and management of, that colony's paper money. Later, as a lobbyist at the British court, he addressed conflicts over paper money between Britain and her colonies. As such, Franklin's views should carry weight.[6] The modeling exercise here is thus an exercise in taking Franklin seriously.

The next section explains the institutional and market constraints facing the colonists

regarding their monetary powers, as well as how the colonists understood and articulated these constraints. The last section uses these constraints to build a series of graphical models to show under what conditions chronic specie scarcity is possible and when this scarcity is, and is not, welfare maximizing. While the model is constructed with the American colonies in mind, it applies to many other small open economies in history.[7]

INITIAL CONDITIONS: INSTITUTIONAL AND MARKET CONSTRAINTS

Institutional and Regulatory Constraints

Colonial governments could not create money *per se*. That was the prerogative of the British Crown (Davis 1964: 1: 271; 4: 206, 219; Nettels 1934: 276). Even if the colonies possessed gold and silver bullion—either mined or imported—the Crown prohibited them from minting their own coins, i.e. specie money. Colonial governments could, however, create transaction-able or exchangeable debt in the form of paper *bills of credit*. The notion of money as tradable debt was closely tied to what the colonies were allowed to create (Newman 2008: 10). As such, a colony's paper money—its bills of credit—had a bearer-bond quality that required an explicit redemption exercise to extinguish the principal expressed on its face (Grubb 2016a).

The British government through the Board of Trade and the proprietors of some colonies exercised oversight of colonial paper money legislation (Brock 1975; Grubb 2008, 2016a). The British Parliament also constrained colonial paper money creation. In 1741, Parliament extended the 1720 Bubble Act to the colonies. This made joint-stock corporations, except those chartered by the Crown, illegal (Harris 1994; Newell 1998: 228-30; Priest 2001: 1379; Smith 1937: 304). Thus, banking operations in the colonies were made prohibitively costly in terms of being able to adequately raise capital and spread risk among stockholders. Joint-stock banks emitting paper banknote money backed by fractional specie reserves would not appear until the American

Revolution ended British rule.[8]

Problems with New England's paper money led Parliament to pass the Currency Act of 1751 (Brock 1975: 168-243; Newell 1998: 231-33; Priest 2001: 1383-84). This act applied only to New England. It outlawed making bills of credit a legal tender in private transactions. It also restricted the emission-to-final-redemption interval to a maximum of two years in peacetime and five years during wartime. Problems with Virginia's bills of credit in the early 1760s led Parliament to pass the Currency Act of 1764 (Brock 1975: 465-528; Ernst 1973: 77-88). This Act applied to all the colonies and outlawed making bills of credit a legal tender. After colonial protests, Parliament in 1773 amended the Currency Act of 1764 to allow bills to be made a *de jure* legal tender for public debts, i.e. for paying the taxes and fees levied by the issuing government (Ernst 1973: 282-311).

Finally, the British government did not allow the colonies to implement capital-trade controls that would inhibit the exportation of specie from the colonies. By contrast, the British government restricted the free exportation of specie from Britain (Perkins 1994: 13). Colonial treasuries never held specie reserves in any meaningful quantities. They functioned primarily as intermediaries between local tax revenue inflows and colonial assembly spending outflows.

Market Constraints

Alongside these governmental constraints, the colonies operated within market forces that circumscribed their money creation abilities. For the most part, the colonists understood these market forces. They had a crude notion of the quantity theory of money—equation (1), transformed into its rate-of-change expression in equation (2).

(1) $M * V = P * Y$

(2) $\%\Delta M + \%\Delta V = \%\Delta P + \%\Delta Y$

Where:
M = the nominal amount of money
V = the velocity of circulation of M (how fast M changes hands per unit time)
P = the nominal price of Y
Y = the volume of real goods and services traded in the economy

Typically, the rates of change of V and Y are assumed to be constant in the long-run, i.e. determined by real factors in the economy such as production technology and commercial trading institutions that change slowly over time. Thus, equation (2) comes close to equation (3) in the long-run and often in the short-run.

(3) $\%\Delta P \approx \%\Delta M$ + a constant

Emitting more paper money should drive prices up (cause currency depreciation), and retiring paper money from circulation should drive prices down (cause currency appreciation).[9]

How colonists described the quantity theory of money with regard to emitting bills of credit, however, differed from equation (3). Colonists thought bills could be emitted to some threshold before prices would be affected causing the currency to depreciate. This threshold was the point where more bills were outstanding at their face value than what were needed to transact the volume of real trade (Y) in the economy (Davis 1964: 2: 57; 4: 55; Lester 1939: 185). In February of 1765, Benjamin Franklin explained (Labaree, Oberg, and Willcox 1969, 12: 52-53),

> It was difficult to know before hand, what Quantity [of bills] would be sufficient for a Medium of Exchange proportion'd to the Trade of the Colony [of Pennsylvania], and not exceed the Occasions.
>
> To prevent the Mischiefs attending an Over Quantity, the Government of Pensilvania began with a small Sum, £15000 in 1723, proceeded to encrease it gradually in following Years, and thus prudently *felt* for a Proportion they could not previously *calculate*. And as they never exceeded a moderate Sum, the Depreciation was never so great as to be attended with much Inconvenience.

In February of 1767, Franklin observed (Labaree, Oberg, and Willcox 1970, 14: 34-35),

> Where the Sums so emitted were moderate and did not exceed the Proportion requisite for the Trade of the Colony, such Bills retain'd a fix'd Value when compar'd with Silver without Depreciation for many Years.... The too great Quantity has, in some Colonies, occasioned a real depreciation of these Bills, tho' made a legal Tender....

> ...[this] Injustice...is avoided by keeping the Quantity of Paper Currency within due Bounds.

In 1780, Franklin still held this view, writing (Labaree, Oberg, and Willcox 1998, 34: 230),

> It has been long & often observed, that when the current Money of a Country is augmented beyond the Occasions for Money, as a Medium of Commerce, its Value as Money diminishes, its Interest is reduced, and the Principal sinks if some Means are not found to take off the surplus Quantity. Silver may be carried out of the Country that produces it, into other Counties, and thereby prevent too great a Fall of its Value in the Country....
>
> Paper Money not being easily receiv'd out of the Country that makes it, if the Quantity becomes excessive, the Depreciation is quicker & greater.

In other words, equation (3) was not a continuum, as it would be if all transactions were effectuated with money. There were alternatives to using bills of credit for executing transactions. When no bills were outstanding, that did not mean that money prices were zero or that no Y was transacted. Exchange still took place, and local prices were approximately the same before versus after bills were first emitted, see Figures 1 and 2. Colonists recognized that there were multiple monies or transacting methods, and that substitution or displacement occurred between them. They were aware that currency substitution factored into how the quantity theory of money constrained their money creation abilities. They had the capacity to price goods in the local unit of account but exchange local goods without money changing hands.

Price series for a few years before, versus a few years after, bills of credit were first emitted exist for Pennsylvania, Maryland, and Virginia. Pennsylvania first emitted bills in 1723, Maryland in 1733, and Virginia in 1755. Figures 1 and 2 show that prices in these colonies, expressed in their respective local units of account, an imaginary money before physical bills expressed in that unit of account were issued, were not zero before paper money was first emitted. Nor were prices substantially different after paper money was first emitted. Sufficient local trade took place to support comparable pricing even when bills of credit as a medium of

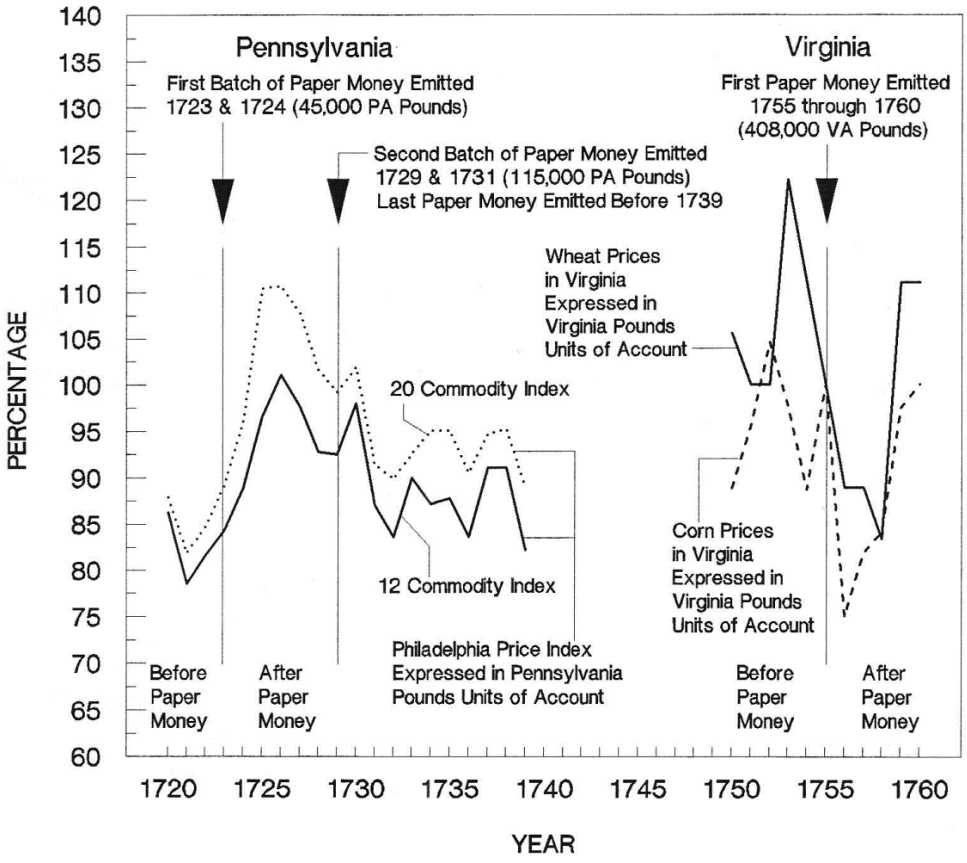

Figure 1. Prices Before and After the First Emissions of Bills of Credit in Pennsylvania and Virginia

Sources: Carter (2006, 5: 685, 687); Bezanson, Gray, and Hussey (1935: 433); Grubb (2016a).

Notes: The Philadelphia data are arithmetic un-weighted price indices with a base year 100 = 1741-45. The Virginia price data are expressed as the percentage of the price listed for 1755.

exchange for that trade had not yet been created.[10]

Colonists thought of money as being made up of specie (outside money) and colonial assembly-issued paper bills of credit (inside money), though they often referred to specie as *real money* and everything else, even bills of credit, as barter.[11] A frequent argument made by contemporaries was that when bills were emitted they displaced specie for internal transactions and thus allowed specie to be exported to buy foreign goods. Only after all the specie had been

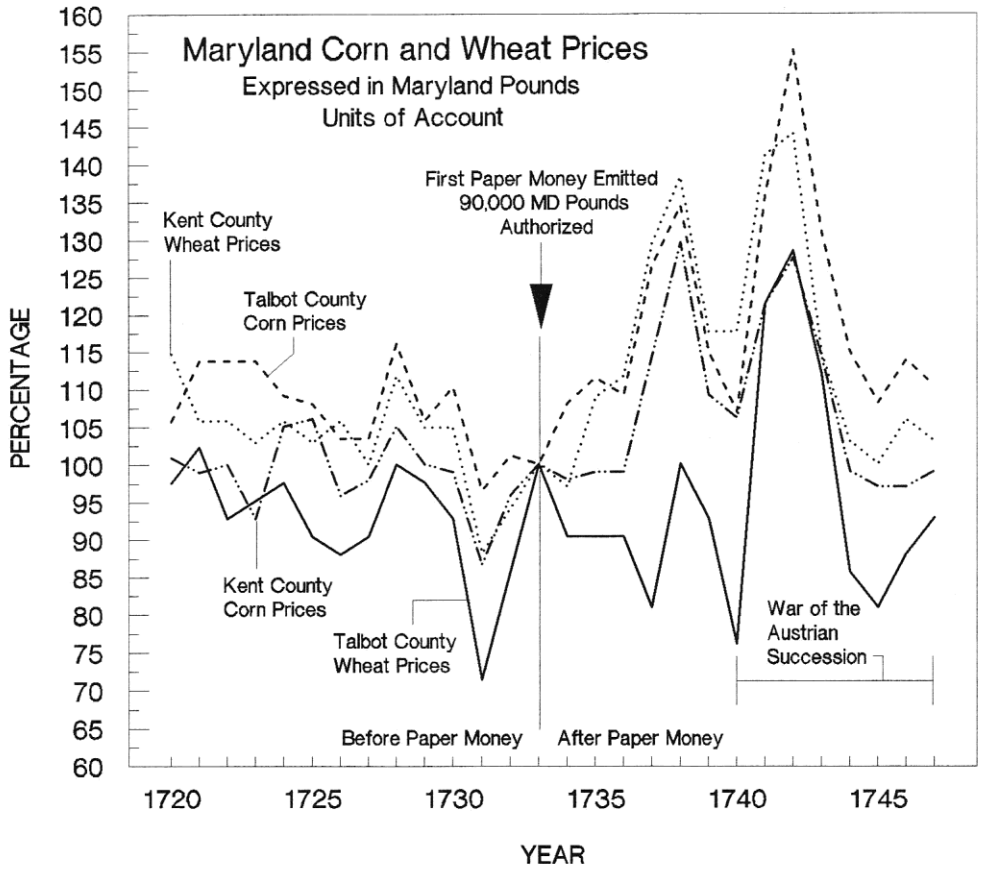

Figure 2. Prices Before and After the First Emissions of Bills of Credit in Maryland

Sources: Clemens (1980: 226-27); Grubb (2016a).

Notes: All prices are expressed as the percentage of the price listed for 1733.

displaced by bills would emissions of additional bills cause prices to rise (cause the bills to depreciate).[12]

This thinking is illustrated in equations (4) and (5) where paper and specie monies are concurrently used with one perfectly substituting for the other in local transactions at a fixed rate.

(4) $M = Mp + \bar{e}Ms$

(5) $\Delta Mp = -\Delta\bar{e}Ms$ up to some threshold αMs where $1 \geq \alpha > 0$

Where:
Mp = the colony's paper bills of credit (inside money)

Ms = specie coins (outside money)
$\bar{e}$ = the fixed exchange rate Mp/Ms

Changes in the emission of bills up to some threshold α are absorbed by exports of specie thereby holding M constant and thus P constant in equation (3). Typically, α is thought to be near 1, meaning that before all specie is exported, every added bill of credit is perfectly offset by an export of specie. Only when an increase in bills goes beyond that absorption threshold will M increase and so P increase, thereby depreciating the bills in circulation.

Adam Smith and David Hume articulated these currency substitution effects filtered through the quantity theory of money (Rotwein 1970: 33-46, 60-77; Smith 1937: 276-313). Their discussions, however, dealt explicitly with paper banknote monies backed by specie reserves and their connection to the specie-flow mechanism for stabilizing the money-price nexus, and not to the type of bills emitted by colonial assemblies. These writers saw the displacement of specie by paper banknotes as welfare enhancing, allowing a country to consume the foreign goods that only specie could buy without locking the specie up as a local transacting medium (see also Lester 1938: 369). Fractional backing of banknotes with specie reserves and the exchangeability of banknotes for their face value in specie on demand by the issuing bank ($\bar{e} = 1$) supported the value of the banknotes.

In 1776, Smith in the *Wealth of Nations* explained (1937: 276-310),

> The substitution of Paper in the room of gold and silver money, replaces a very expensive instrument of commerce with one much less costly, and sometimes equally convenient....
>
> There are several different sorts of paper money; but the circulation of notes of banks and bankers are...the best known, and which seems best adapted for this purpose....
>
> The whole paper money of every kind which can easily circulate in any country never can exceed the value of the gold and silver, of which it supplies the place... Should the circulating paper at any time exceed that sum, as the excess could neither be sent abroad nor be employed in the circulation of the country, it must immediately return upon the banks to be exchanged for gold and silver.... There would immediately, therefore, be a run upon the banks to the whole extent of the superfluous paper...

> A paper money consisting in bank notes, issued by people of undoubted credit, payable on demand [in specie] without condition, and in fact always readily paid as soon as presented, is, in every respect, equal in value to gold and silver money; since gold and silver money can at any time be had for it....
>
> The increase of paper money, it has been said, by augmenting the quantity, and consequently diminishing the value of the whole currency, necessarily augments the money price of commodities. But as the quantity of gold and silver, which is taken from the currency, is always equal to the quantity of paper which is added to it, paper money does not necessarily increase the quantity of the whole currency....
>
> [However] The paper currencies of North America consisted, not in bank notes payable [at face value in specie] to the bearer on demand, but in a government paper...

This banknote paper money system was held in equilibrium by the specie-flow mechanism. If local prices rose, people would take whatever specie reserves they had and export them to buy lower-priced foreign goods. This would contract the local money supply, both specie and paper banknotes because the banknotes were linked fractionally to the specie reserves held against them. This contraction would reduce local prices, via equation (3), until foreigners would send specie into this economy to purchase the locale's now lower-priced goods. This process held economies in a monetary price level equilibrium. In this Hume-Smith world, chronic specie scarcity is impossible (Rotwein 1970: 33-46, 60-77).

Benjamin Franklin pointed out that this Hume-Smith monetary price level equilibrium among trading economies was not applicable to the colonial setting. First, no one stood ready to exchange colonial bills of credit at face value for specie on demand. Neither colonial legislatures nor colonial treasuries nor consortiums of colonial merchants were capable or willing to do such on a consistent basis. There was no fixed exchange rate ($\bar{e}$) between colonial bills and specie that colonial treasuries defended by buying and selling their colony's bills of credit for specie. Colonial treasuries simply did not have the specie reserves to defend a fixed exchange rate. Specie-to-bill equivalencies were set for tax-receipt purposes only. In the marketplace, exchange rates between bills and specie were free and flexible. As such, equation (5) did not function as a

currency substitution mechanism in the colonies because flexible exchange rates (Δe) between Mp and Ms could absorb changes in one without altering the amount of the other.

Second, Franklin pointed out that specie had fled local exchange long before the colonies issued bills of credit. The margin of displacement was not between bills and specie. According to Franklin, before 1723 Pennsylvania had no specie money and no paper money. Yet Figure 1 shows prices were not all that different before compared with after paper bills were first emitted as a medium of exchange. Similar observations hold for Maryland before versus after 1733 and Virginia before versus after 1755.[13] In March of 1767, Franklin explained (Labaree, Oberg, and Willcox 1970, 14: 77-79),

> In Report of the [British] Board of Trade, dated February 9, 1764, the following Reasons are given for restraining the Emission of Paper Bills of Credit in America, as a Legal Tender....
>
> To consider these Reasons in their Order. The first is, *That Paper Money carries the Gold and Silver out of the Province, and so ruins the Country, as Experience has shewn in every Colony where it has been practised in any great Degree*. This seems to be mere speculative Opinion, not founded on Fact in any of the Colonies. The Truth is, that the Balance of Their Trade with Britain being generally against them, the Gold and Silver is drawn out to pay that Balance; and then the Necessity of some Medium of Trade has induced the making of Paper Money, which could not be carried away. Thus, if carrying out all the Gold and Silver ruins a Country, every Colony was ruined before it made Paper Money.
>
> ...Pennsylvania, before they made any Paper Money, was totally stript of its Gold and Silver,...
>
> The Balance of Trade carry'd out the Gold and Silver as fast as it was brought in,...

In the absence of specie and paper monies, local exchange was transacted with barter but not barter as is commonly articulated by economists. It was not the crude barter that requires a double coincidence of wants for exchange to be consummated. Colonists did not go door to door with piglets under their arms searching for neighbors who had and were willing to trade boxes of candles for said piglets. The high transactions cost of this kind of barter explains why it was not commonly observed. The barter that colonists developed was what will be termed *efficient*

barter. Efficient barter entailed exchange organized around shop-notes, store book-credit accounts, and tradable individual bonds with local goods priced in common units of account which allowed easy relative pricing and account clearing across multiple trades and traders.[14] Centralized clearing of credits and debts obviated the double-coincidence-of-wants problem. These efficient barter structures for executing domestic transactions had already displaced specie before colonies turned to issuing paper monies.

Efficient barter is illustrated by Henry Callister, a merchant storekeeper in Townside [Crumpton], Maryland. Callister was shipping wheat to Philadelphia sold to him by local planters, and importing goods from Philadelphia to sell back to these same planters. In 1762, Callister's store manager, Nathan Wright, asked what Callister would accept in payment from local customers to clear their store credit accounts. Callister's response to Wright was that he would accept almost anything, i.e. any monies, bills, or goods (*Callister Papers*, material just prior to the letter dated 18 January 1762; Tyler 1978). The clearing of store credit accounts was flexible with relative indifference between the means used.

When colonial governments issued bills of credit, the margin of currency substitution was efficient barter, not specie. If efficient barter is thought of as sponge-like, possessing plasticity, then the scope for expanding and contracting the quantity of bills in circulation without affecting prices is large. Only when the quantity of bills rose to some threshold replacement of efficient barter would further emissions drive up prices causing currency depreciation. This hypothesis is depicted in equations (6) and (7).

(6) $M = EB + Mp + (e\text{Ms} \approx 0)$

(7) $\Delta Mp = -\Delta EB$ up to some threshold γEB where $1 \geq \gamma > 0$

Where:
M = all transacting mediums, with $M > M$, namely $M = M + EB$

EB = efficient barter, e.g. store book credit transacted in a common unit of account
Ms ≈ zero due to prior displacement by EB

In other words, the link between money and prices in the quantity theory of money is spongier given the nature of EB than that expressed in equations (3) and (4).[15] The importance of equation (6) is that it creates room for endogenous inside "monies."[16] These endogenous monies were barter-debt exchange structures possessing a hierarchy of efficiencies or transacting costs. Equation (7) implies that the excess utility value or the transactions opportunity cost of using specie, or even bills of credit, for executing domestic transactions was not infinite, i.e. there were ways to exchange goods that involved no transfer of money in the form of specie or bills.

A TRANSACTIONS COST MODEL OF CHRONIC SPECIE SCARCITY

What follows is a transactions cost model of monetary choice.[17] It takes the colonists seriously in their claims that 1) specie was chronically scarce, and 2) this scarcity predates the emission of paper monies. Efficient barter as "money" for executing domestic transactions, and the fact that imports can only be purchased with specie, are used to demonstrate that chronic specie scarcity in colonial America was possible, despite unrestricted specie-market arbitrage. Relative welfare outcomes are compared. The model proceeds through four figures that follow the historical sequence of trade and monetary development in colonial America.

Modeling Assumptions and Terminology

The model assumes a small open economy/polity, e.g. an individual American colony, with n people. All people are assumed to have identical demands for domestic transactions, i.e. $Demand_i = Demand_j = ... = Demand_n$ with each being a normal downward sloping curve. Domestic transactions are trades between people within this polity.

Specie (sm) is exogenous or outside money. It is the money the rest of the world uses to consummate transactions that cross polity borders. Specie is not produced or minted in this

polity. In exchange for exported goods, specie is imported. No barriers to foreign trade or specie flows exist. Imported goods can only be purchased with specie. Domestically produced goods cannot be easily substituted for imported goods. Domestically produced goods can be purchased within this polity with specie or barter (b). The transaction cost (TC) of using barter to consummate an exchange is always higher than when using specie ($TC_b > TC_{sm}$).

Specie has a separate opportunity cost (OC_{sm}) when used for domestic transactions, namely the imported goods that could have been purchased with that specie.[18] When specie is not used, the alternative to using barter is autarky ($Y_{autarky}$), i.e. an individual produces and consumes his own goods without trading with others in the polity. Barter has no separate opportunity cost ($OC_b = 0$). It cannot be used to purchase imported goods, and the demand curve for domestic transactions captures the autarky alternative to barter.[19]

Individuals are price-takers in the market. Thus TC_b, TC_{sm}, and OC_{sm} are perfectly elastic, namely the transactions cost for each mode of exchange is the same for each successive exchange using that mode. Individual economies/polities are small compared with their respective global markets and so are price-takers with regard to imports and exports that cross their borders. Different barter structures are assumed to have a hierarchy of transaction-cost efficiencies relative to specie. While $TC_b > TC_{sm}$ is always true, the gap between them can vary. Barter is endogenous "money" for executing domestic trades.

Three different barter structures are used.[20] Figures 3 and 4 assume relatively inefficient *crude barter* (cb), i.e. domestic trade via a double coincidence of wants. A man with a pig who wants to trade that pig for a particular box of candles searches for a man with the desired box of candles willing to trade it for that exact pig. Figure 5 assumes *efficient barter* (eb), such as domestic trade organized around a third-party storekeeper who uses book credit or shop-notes to

clear domestic transactions. Unlike crude barter, efficient barter possesses some localized credit-money characteristics with store debits and credits transferable across store customers. Figure 6 assumes *efficient enhanced barter* (eeb), such as when a polity creates an inside paper money or credit/debt instrument that can be used for domestic transactions throughout the polity. These paper monies cannot be directly used to acquire imported goods in the sense that the foreign seller will not accept it in payment nor can this seller be compelled to accept it in payment.

An initial stock of specie acquired from prior-period exports in the hands of $Demander_i$ is exogenously given, i.e. the starting point in the model. Will $Demander_i$ use this specie to execute domestic transactions or export it to acquire imported goods, thereby removing this specie from society so that it cannot serve as a medium of exchange in subsequent domestic transactions?

Baseline Model: Figures 3 and 4

Figure 3 presents the baseline position upon which subsequent figures are built. It graphs the cost of domestic transactions against the quantity of domestic transactions. A standard downward sloping demand curve for a given individual is drawn. If costs are too high, no domestic transactions are demanded. The result is autarky ($Y_{autarky}$). An individual produces and consumes his own goods without trading with others in the polity.

If the cost of domestic transactions is zero, Y_{max} is demanded. Constraints to domestic production, namely exogenously given resource and technology constraints in the production function and the gains to specialization across individuals in the polity, determine Y_{max}. The summation of Y_{max} across people in this economy approximates the maximum potential gross domestic product attainable. The transactions costs of executing domestic trades are always positive and so the quantity of domestic transactions demanded is less than Y_{max}.

The transactions cost of crude barter (TC_{cb}) is substantially greater than the transactions

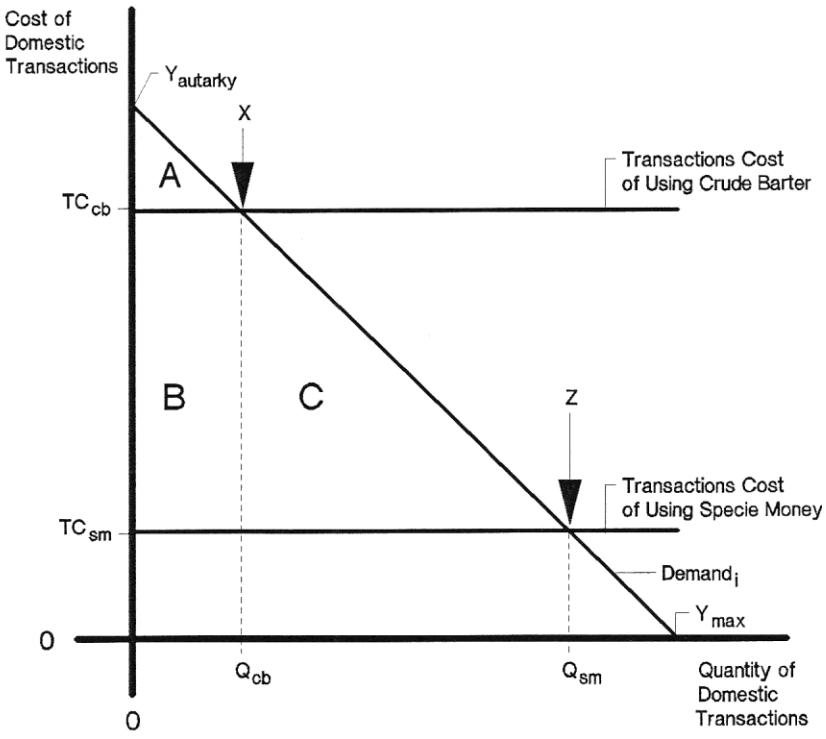

Figure 3. The Preliminary Baseline Model of Domestic Transactions in a Closed Economy

cost of using specie (TC_{sm}) which, in turn, is somewhat greater than zero ($TC_{cb} >>> TC_{sm} > 0$). Several factors keep TC_{sm} above zero. Identifying counterfeit coins is costly, e.g. is that a silver or a pewter dollar? Carrying heavy metallic substances is costly. Determining whether specie coins have been debased, clipped, cut, worn, or otherwise adulterated in ways that reduce their value, or make them harder to identify, is costly. Making change may be difficult if small denominations are not minted. Finally, determining the relative value of different coins is costly, e.g. what is the value of a gold Spanish pistole compared with a gold English crown?

The high value of TC_{cb} in absolute terms, as well as relative to TC_{sm}, comes from the double coincidence of wants underlying crude barter. The cost of this kind of barter is so absurdly high that no one would engage in it except in rare isolated cases. Assuming that crude barter is the only alternative to money is a standard trope used by economists to justify the

existence of money and its absolute primacy in trade.[21] Barter is so costly that domestic transactions will only take place using money. No transaction can take place without money, and no money can change hands without it being part of a transaction. In other words, the opportunity cost of using money is assumed to be nearly infinite. Assuming money rather than explaining it allows economists to do money-price-output analysis without caveats.

Positing crude barter as the only alternative to money, however, assumes people are willfully stupid—a position anathema in economics. People search for and develop cost-minimizing barter structures superior to crude barter. The subsequent figures relax this stupid-crude-barter assumption and explore what happens when cost-minimizing forms of efficient and enhanced barter are used.

The outcome of the baseline model illustrated in Figure 3 is straightforward. Comparing the equilibrium for using specie, point Z, with that for crude barter, point X, shows that the quantity of domestic transactions is greater using specie, i.e. $Q_{sm} > Q_{cb}$. More importantly, it shows that the consumer surplus (the area under demand that is above cost) is larger when using specie than when using crude barter, i.e. area (A + B + C) > area A. The net welfare gain from using specie is the area (B + C).

This outcome is true for the initial Demander_i, as well as for each subsequent $\text{Demander}_{j \text{ through } n}$. Demander_i starts with an initial stock of specie. His incentive is to use it, rather than crude barter, to execute domestic transactions. His net gain from doing so is area (B + C). The person in the economy with whom he transacts now has that stock of specie and faces the same conditions that Demander_i faced in Figure 3. This person will thus make the same decision.

As such, chronic specie scarcity for executing domestic transactions will not exist, and this use of specie is welfare enhancing for the society. Each individual gains area (A + B + C)

when using specie to execute domestic transactions compared with area A when using crude barter. No matter how many individual demanders (n) participate in domestic transactions, it will always be true that $n(A + B + C) > n(A)$.

Figure 3 assumes a closed economy. Yet specie initially entered this economy in exchange for exported goods. The presence of specie assumes an open economy. Figure 4 adds an open economy to Figure 3 by adding an opportunity cost of using the initial stock of specie for domestic transactions (OC_{sm}), namely the loss of the imported goods that could have been purchased by $Demander_i$ with that specie. The total cost of using specie to execute domestic transactions is $(TC + OC)_{sm}$.

Adding an open economy does not change the outcomes in Figure 3 as long as OC_{sm} is small compared with the gap between TC_{cb} and TC_{sm}. While the quantity of domestic transactions is still greater when using specie, the welfare assessment of using specie for consummating domestic transactions is altered. In Figure 4 the consumer surplus from using specie to execute domestic transactions for $Demander_i$ must be assessed at point W rather than at point Z, because there is an additional cost to using specie for executing domestic transactions, namely the imported goods foregone that the specie could have purchased. If $Demander_i$ uses his specie to buy imported goods, and so must use crude barter to execute his domestic transactions, he gains area (A + F + G), e.g. the value of bartered domestic goods plus the value of imported goods. Alternatively, if $Demander_i$ uses specie to execute his domestic transactions and so foregoes buying imported goods, he gains area (A + B + C), namely [(A + B + C + F + G) - (F + G)]. Comparing the welfare gains from using crude barter, area (A + F + G), with the welfare gains from using specie to execute domestic transactions, area (A + B + C), hinges on comparing area (B + C) with area (F + G).

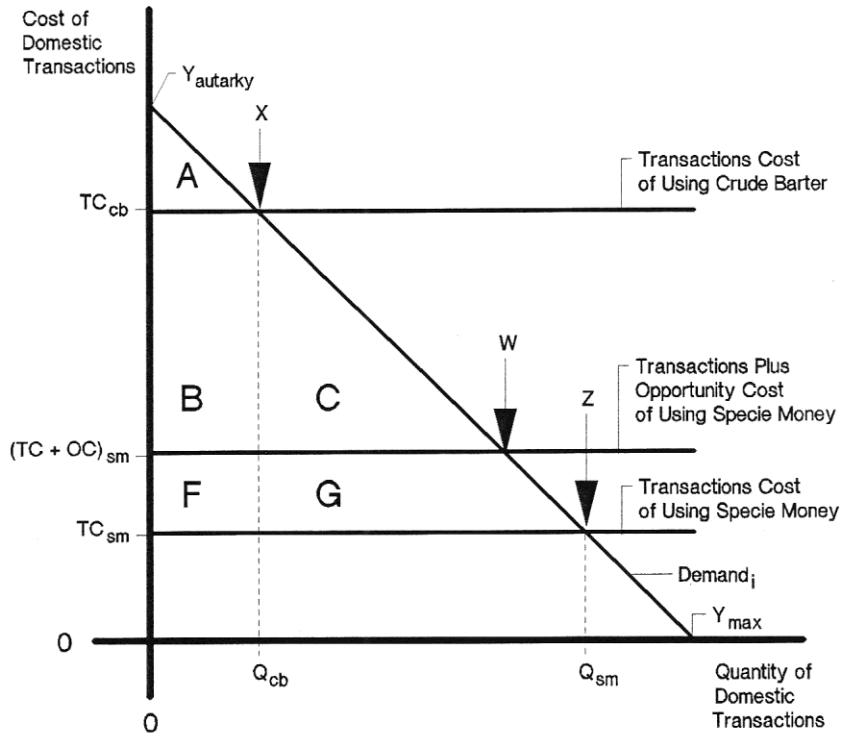

Figure 4. The Preliminary Baseline Model of Domestic Transactions in an Open Economy

As long as area (B + C) > area (F + G) the choice of what to use to execute domestic transactions and the welfare outcome from Figure 3 will not change. $Demander_i$ has an incentive to use his initial stock of specie, rather than crude barter, to execute domestic transactions. His net gain is area [(B + C) - (F + G)] > 0. The person with whom he exchanges his specie for local goods now has that stock of specie and faces the same conditions as $Demander_i$. This person will thus make the same decision. The outcome that is true for the initial $Demander_i$ is also true for each subsequent $Demander_{j \text{ through } n}$.

Under the condition in Figure 4, when area (B + C) > area (F + G), chronic specie scarcity will not exist, and the use of specie for executing domestic transactions, rather than crude barter, will be welfare enhancing. Each individual gains area (A + B + C) using specie to execute domestic transactions compared with area (A + F + G) when using crude barter. No

matter how many individual demanders (n) participate in domestic transactions, it will always be true that $n(A + B + C) > n(A + F + G)$.

Efficient Barter: Figure 5

Figure 5 replaces the stupid-crude-barter assumption with a more efficient barter structure. Efficient barter is, basically, credit between reciprocating or networked trading partners, priced in an accepted unit of account. In the colonial economy, this *efficient barter* (eb) can be thought of as domestic trade organized around a third-party central storekeeper who uses book credit or shop-notes as a kind of endogenous inside "money" for clearing transactions among customers. Unlike crude barter, efficient barter has some localized transferable credit-money characteristics.

TC_{eb}, while lower than TC_{cb}, still exceeds that of the transactions and opportunity cost of using specie for executing domestic trades, namely $TC_{cb} > TC_{eb} > (TC + OC)_{sm}$. However, Figure 5 assumes that the opportunity cost of using specie for domestic transactions (F + G) is greater than the consumer surplus gained by using specie rather than efficient barter for domestic transactions (B + C). That is, Figure 5 assumes that $(TC_{eb} - TC_{sm}) > OC_{sm} \geq (TC_{eb} - TC_{sm})/2$.[22] While the quantity of domestic transactions is still greater when using specie, the choice of the domestic transacting medium and the welfare outcome of this choice are different in Figure 5 compared with that in Figures 3 and 4.

If $Demander_i$ uses his initial stock of specie to execute domestic transactions, his consumer surplus is area (A + B + C), namely area [(A + B + C + F + G) - (F + G)] because he has to subtract the opportunity cost of the foregone imported goods that the specie could have purchased (F + G) from his net gain at point Z. Alternatively, if $Demander_i$ uses his specie to buy imported goods and uses efficient barter to execute domestic transactions, his consumer

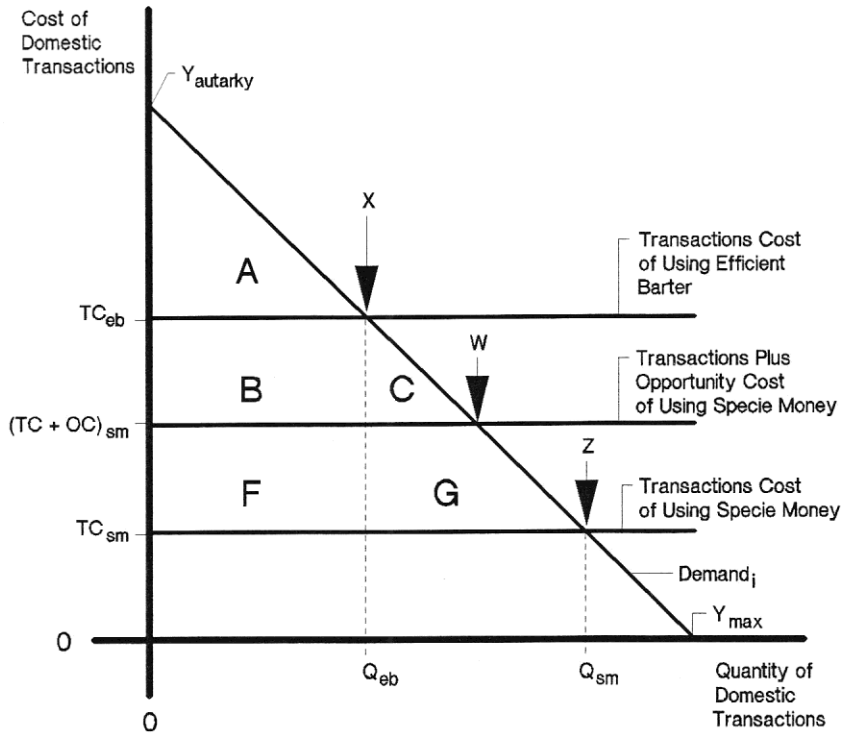

Figure 5. Adding Efficient Barter Structures to the Model

surplus is area (A + F + G), i.e. the gain from having the imported goods (F + G) plus the gain from the barter of domestic goods (A). Given the assumption above that $OC_{sm} \geq (TC_{eb} - TC_{sm})/2$, the area (F + G) is always greater than the area (B + C). Therefore, $Demander_i$ comes out ahead using his specie to buy imported goods and using efficient barter to execute domestic transactions. Any specie that enters the polity will be immediately exported to buy imported goods and not be used to execute domestic transactions. Chronic specie scarcity for executing domestic transactions is the result.

While immediately exporting one's specie to buy imported goods is the optimal behavior for each individual, it is not the welfare maximizing outcome for society as $n \rightarrow \infty$. If $Demander_i$ follows his individual welfare maximizing choice, then his specie is no longer available for $Demanders_{j \text{ through } n}$ to use for executing domestic transactions. Only $Demander_i$ gets the benefit of the imported goods that his specie purchased. Each individual with an initial stock of specie

faces this situation. They cannot see nor capture the positive externality of having their specie available for executing all subsequent domestic transactions by others in the polity.[23]

If Demander_i follows his individual welfare maximizing choice, he receives area (A + F + G). Because the specie was exported, it is not available for $\text{Demanders}_{j \text{ through } n}$ to use. Thus, $\text{Demanders}_{j \text{ through } n}$ can only use efficient barter to execute domestic transactions, with each receiving area (A) only. Thus, the total social welfare for all demanders in this polity is area (A + F + G) for Demander_i and area (n - 1)A for the rest of society, i.e. for $\text{Demanders}_{j \text{ through } n}$. As such, total social welfare under this outcome is area [nA + (F + G)].

By contrast, suppose each demander goes against his individual welfare maximizing choice and uses his initial stock of specie to execute domestic transactions, foregoing the purchase of imported goods with his specie. Because specie is passed from one demander to the next, it circulates through the polity executing all domestic transactions. As such, each demander receives a welfare gain of area (A + B + C). Because each demander in society gets this individual welfare, total social welfare is area n(A + B + C) or [nA + n(B + C)].

Comparing the two outcomes shows that even when n is not large, and certainly as $n \rightarrow \infty$, social welfare is maximized by retaining specie to execute domestic transactions and foregoing using the specie to purchase imported goods, i.e. [nA + n(B + C)] > [nA + (F + G)]. The one-off benefit to Demander_i of exporting his specie for imported goods (F + G) is exceeded by the subsequent foregone benefit of n(B + C) for all subsequent $\text{Demanders}_{j \text{ through } n}$ of not having that specie available to execute their domestic transactions. In other words, while area (B + C) < area (F + G), area n(B + C) > area (F + G) as $n \rightarrow \infty$.

Figure 5 shows plausible conditions under which chronic specie scarcity, despite unrestricted specie-market arbitrage, can occur even when such is sub-optimal in terms of social

welfare. Optimal individual actions lead to sub-optimal social outcomes (Davis, 1964, v. 2, 77). These conditions were present in British North America during the late seventeenth and early eighteenth centuries. As such, chronic specie scarcity before any colony had issued its own paper currencies is plausible—an outcome produced by individual rational maximizing behavior.

The sub-optimal welfare outcome in Figure 5 can be ameliorated by policies such as banning specie exports, raising import tariffs, or encouraging import substitution so that OC_{sm} is reduced until area (B + C) > area (F + G). Such policies could eliminate the incentive individuals have to export their specie to purchase imported goods. Given that British regulations largely prohibited the colonies from imposing tariffs on British imports, banning specie exports, and systematically encouraging import substitution, some other colonial policy was needed to overcome the sub-optimal social welfare outcome in Figure 5.

Enhanced Efficient Barter: Figure 6

Figure 6 modifies Figure 5 by assuming that barter structures can be enhanced to create a broadly accepted way to clear transactions throughout the polity, called here *enhanced efficient barter* (eeb). The use of enhanced efficient barter for domestic exchange, given its transaction costs, may be sufficient to create a larger consumer surplus than the use of specie for that exchange, given its transaction *and* opportunity costs. Figure 6 assumes that this enhancement is sufficiently large enough to cause $(TC_{eeb} - TC_{sm}) \leq OC_{sm}$. While the pure transactions cost of using specie is always lower than the transactions cost of using barter to execute domestic transactions, no matter how efficient the barter structure, i.e. $TC_{sm} < TC_{eeb}$, the full cost of using specie to execute domestic transactions is now greater than the pure transactions cost of barter for executing domestic transactions, i.e. $(TC + OC)_{sm} \geq TC_{eeb}$. The transactions-cost gap is narrowed enough by enhanced efficient barter to make the opportunity cost of not using specie to

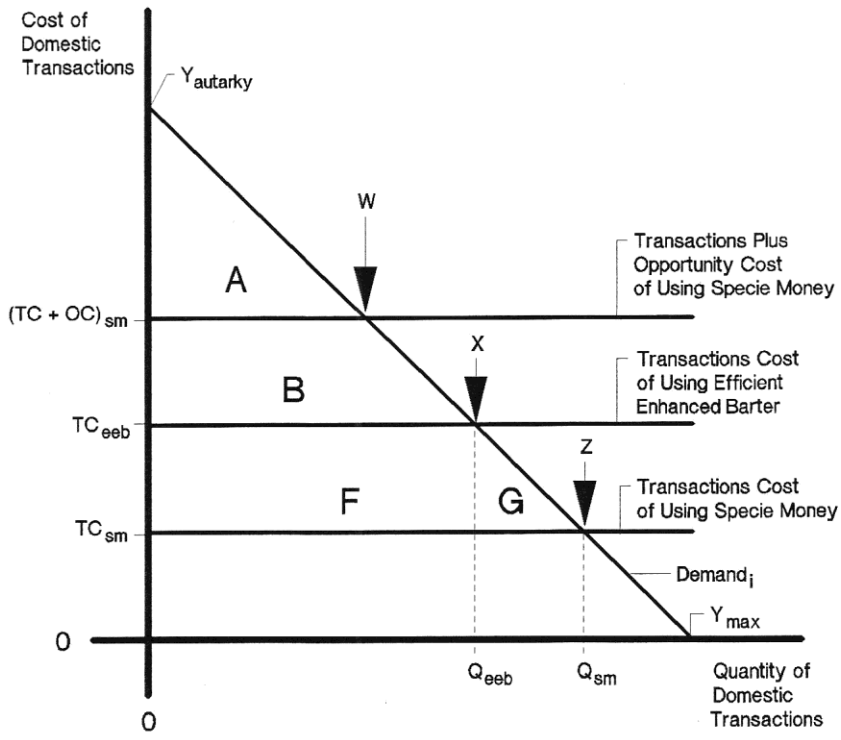

Figure 6. Adding Enhanced Efficient Barter Structures to the Model

purchase imported goods the dominant cost consideration for society. The failure to achieve significant import substitution via domestic production is an important determinant of the outcome in Figure 6.

Enhanced efficient barter was accomplished by colonial legislatures creating their inside own paper monies, monies accepted throughout the polity but not outside that polity. Colonial paper money functioned as transaction-able debt instruments or bearer-bonds. They were anchored to real values in the economy that could be claimed with that money. The most ubiquitous real-value anchors were to the future taxes levied by the colonial government issuing said money (Grubb 2016a). In effect, the colonies created fixed exchange rates between the face value of their bills and specie, but only at specific future dates for designated amounts of bills outstanding, as opposed to creating convertibility at a fixed exchange rate *on demand* between all

bills and specie as was the case for nineteenth-century banknotes. These anchors gave the money general acceptance within the issuing polity. This general acceptance was a step beyond efficient barter structures which were confined to local exchangeable store book-credits or shop-notes that required repeat transactions and reputation development among the store participants to sustain that barter structure's efficiency.

Figure 6 is similar to Figures 3, 4, and 5 in that equilibrium point Z is to the right of point X with $Q_{sm} > Q_{eeb}$. The choice of the domestic transacting medium and the welfare outcome of this choice, however, differ. In Figure 6, the cost assessment point for using specie to execute domestic transactions, point W, is to the left of that point for using barter, point X, whereas in Figures 3, 4, and 5 the reverse is true. This difference comes from the assumption in Figure 6 that OC_{sm} exceeds the transactions-cost differential between using specie and barter for executing domestic transactions, a condition not present in Figures 3, 4, and 5.

In Figure 6, if $Demander_i$ uses his initial stock of specie to execute domestic transactions, his consumer surplus is area A, i.e. area [(A + B + F + G) - (B + F + G)] because he has to subtract the opportunity cost of the foregone imported goods that the specie could have purchased (B + F + G) from his net gain at point Z. Alternatively, if $Demander_i$ uses his specie to buy imported goods and uses enhanced efficient barter to execute domestic transactions, his consumer surplus is area (A + 2B + F + G), i.e. the gain from having the imported goods (B + F + G) plus the gain from the barter of domestic goods (A + B). Given the assumption in Figure 6 that $OC_{sm} \geq (TC_{eeb} - TC_{sm})$, the area (A + 2B + F + G) is always greater than the area A. Therefore, $Demander_i$ comes out ahead by using his specie to buy imported goods and using enhanced efficient barter to execute domestic transactions. The outcome for $Demander_i$ in Figure 6 is the same as in Figure 5. In both cases, $Demander_i$ has a personal welfare maximizing

incentive to export his initial stock of specie rather than use it to execute domestic transactions. The only difference for $Demander_i$ is that his welfare gain is larger in Figure 6 than in Figure 5. In both cases, chronic specie scarcity for executing domestic transactions is the result.

While immediately exporting one's specie to buy imported goods is the optimal behavior for each individual in both Figures 5 and 6, it is not the welfare maximizing outcome for society as $n \rightarrow \infty$ in Figure 5 but is the welfare maximizing outcome for society as $n \rightarrow \infty$ in Figure 6. This is the key difference between Figures 5 and 6, between efficient and enhanced efficient barter. Figure 6 eliminates the sub-optimal social welfare outcome in Figure 5. The development of enhanced efficient barter structures in Figure 6 aligns individual welfare maximizing behavior with social welfare maximizing outcomes.

In Figure 6, if $Demander_i$ follows his individual welfare maximizing choice and exports his specie to acquire imported goods, then this specie is no longer available for $Demanders_{j \text{ through } n}$ to use for executing domestic transactions. Each individual who has an initial stock of specie faces this situation. $Demander_i$ receives area (A + 2B + F + G) from this choice, and $Demanders_{j \text{ through } n}$ can only use enhanced efficient barter to execute domestic transactions, with each receiving area (A + B) only. Thus, the total social welfare for all demanders in this polity will be area (A + 2B + F + G) for $Demander_i$ and area (n - 1)(A + B) for the rest of society, i.e. for $Demanders_{j \text{ through } n}$. Total social welfare under this outcome is area [nA + nB + (B + F + G)].

By contrast, suppose each demander goes against his individual welfare maximizing choice and uses his specie to execute domestic transactions, foregoing the purchase of imported goods with that specie. Because specie is continuously passed from one demander to the next, it circulates throughout the polity executing all domestic transactions. As such, each demander receives a welfare gain of area A. Because each demander in society gets this individual welfare,

total social welfare is area n(A).

Comparing these two outcomes, for any n, even $n \rightarrow \infty$, social welfare is maximized by not retaining specie to execute domestic transactions, i.e. $nA < [nA + nB + (B + F + G)]$. The one-off benefit to the initial demander of exporting his specie for imported goods (B + F + G) always exceeds the subsequent foregone net benefit to all subsequent demanders of not having that specie for executing their domestic transactions. The opportunity cost of using specie to buy imported goods dominates the welfare assessment both for the individual and for society. Figure 6 shows plausible conditions under which chronic specie scarcity, despite unrestricted specie-market arbitrage, can occur and be welfare enhancing for the society.

Evolution of Colonial Regimes

The British North American colonies can be characterized as evolving from Figures 4 to 5 to 6. Early on, colonial societies developed efficient barter structures. This induced chronic specie scarcity that was socially sub-optimal. To eliminate this sub-optimal welfare outcome, colonies created viable inside paper monies that allowed them to capture the value of the imported goods that only specie could buy while also being able to efficiently execute domestic transactions.

The evolution from efficient to enhanced efficient barter did not eliminate chronic specie scarcity, but it did ameliorate the sub-optimal welfare outcome that efficient barter caused and so may have encouraged domestic economic development.[24] The incentive to move from Figures 5 to 6 increases as a colony's population increases, because the social welfare loss in Figure 5 increases with population growth, and population growth itself will not overcome the sub-optimal social welfare outcome in Figure 5. As colonies grew, they systematically moved from a Figure 5 to a Figure 6 regime.

CONCLUSIONS

American colonists claimed that gold and silver coins were chronically scarce for executing domestic transactions despite unrestricted trade in specie. Chronic specie scarcity was not caused by currency substitution between paper and specie monies. It was caused by the prior development of locally efficient barter structures. This led welfare maximizing individuals to export all their specie causing a socially sub-optimal welfare outcome in domestic transactions. Subsequent creations of inside paper monies by colonial governments mitigated the socially sub-optimal welfare outcomes of this efficient-barter-induced chronic specie scarcity. The model of chronic specie scarcity developed here is also consistent with, and makes sense of, contemporary colonial commentators who saw the lack of import substitution as contributing to specie scarcity.[25] These commentators considered policies that encouraged import substitution as a potential solution to chronic specie scarcity.

The driving force behind the evolution of monetary transaction regimes modeled here is the relative size of the opportunity cost of using specie to execute domestic transactions, namely the foregone imports that specie could purchase, compared with the transactions cost gap between using that specie versus the next best inside barter "money" for executing domestic transactions. As this opportunity cost is driven toward zero via domestic economic development that yields import substitution, namely as domestic goods and imports become closer substitutes, chronic specie scarcity disappears. Given that the outside money is transaction cost superior in all trades, the outside money will be retained for use in future domestic transactions given that imported goods have no superiority over domestic good substitutes. As such, chronic specie scarcity is more prevalent in small underdeveloped colonial export-driven economies with limited domestic production sectors.

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Footnotes

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* Professor of economics and research associate at the National Bureau of Economic Research, Economics Dept., University of Delaware, Newark, DE 19716, USA. Email: grubbf@udel.edu. Webpage: http://lerner.udel.edu/faculty-staff-directory/farley-grubb/. Preliminary versions were presented at the Third European Congress on World and Global History, London School of Economics, London, UK, 14-17 April 2011; The Institute for Global Law and Policy Pro-Seminar on Re-Theorizing Liquidity, Harvard Law School, Cambridge, MA, 6-9 June 2011 and 2 June 2012; the Conference on "De-Teleologising History of Money and Its Theory," Japan Society for the Promotion of Science Research—Project 22330102, University of Tokyo, 14-16 February 2012; University of Delaware, 11 October 2012; and Allied Social Science Associations Annual Conference, San Diego, 5 January 2013. The author thanks the participants of these conferences and Christine Desan, Alejandro Komai, Akinobu Kuroda, and Angela Redish for helpful comments.

[1] See *Archives of Maryland* (14: 174, 390-1; 39: 92; 61: 265; 62: 133; 63: 242); Baxter (1965: 11-12; 2004); Bezanson, Gray, and Hussey (1935: 322); Breen (2004: 98); Brock (1975: 1-18, 25-29, 70-76, 86-87, 92, 106-108, 113-15, 137, 141-45, 150-51, 154, 165-66, 169, 176, 230, 240-41, 267-68, 283, 324, 333, 350-51, 353-56, 361, 386-88, 413, 429-31, 438-39, 443-45, 447, 456, 462, 464, 466, 468, 497, 524, 529, 532, 536, 550); Bullock (1900: 125-28, 143-44, 153, 161, 167-69); Bush (1977: 301; 1986: 212); Clark, Saunders, and Weeks (1886-1907, 3: 294; 4: 178; 5: 234-35, 851; 6: 1,274, 1,282; 7: 61-88, 394, 572, 928; 9: 142; 23: 781); Davis (1964, 1: 55, 62, 70-71, 113-14, 123, 131, 144, 155, 177, 183-87, 189, 192-93, 200-204, 210-12, 233-34, 254-55, 259, 270, 298, 310-11, 320, 336-37, 352-61, 379, 387, 398, 401-403, 407-408, 418-35; 2: 7-9, 23, 27, 67, 69-89, 98, 101, 112-13, 150-55, 165-69, 174-76, 184, 234-35, 237, 280, 293-94, 307, 312, 321, 379, 396, 433-34, 449, 453-54; 3: 3-4, 35-36, 67, 80-87, 94-96, 130-33, 145-46, 152-56, 160-67, 172-74, 193-95, 198-200, 203-204, 207, 211-13, 225-26, 256, 276, 289, 297, 314, 339, 341, 370-72, 386-87, 391, 406-407, 412, 430, 439-40, 446-47, 450-52, 456, 462-67, 474; 4: 4, 22-23, 33-34, 56, 110, 120, 150, 193-98, 211, 234, 380-82, 390-91, 416-17, 437-42, 452); Ernst (1973: 199-206); Fisher (1911: 273, 289-90, 294); Flynn, Karahan, and Schwartz (2018); Grubb (2004; 2006a; 2006b; 2008); Hammond (1957: 11); Hening (1819, 6: 467); Kemmerer (1939: 868-69; 1940: 121, 123, 282, 304; 1956: 107-12, 137-39, 142); Labaree, Oberg, and Willcox (1959-1974, 1: 14, 152; 4: 345-48; 5: 194-95, 244, 246; 7: 123; 9: 147; 11: 13; 13: 449, 466-67; 14: 33-34, 38, 77-87, 232, 286-87; 16: 2, 254; 18: 135); Lester (1938: 326-28, 330-38, 346-48, 351, 359-60, 368; 1939: 184, 186, 188-90, 208, 213); McCusker (1978: 117-18); McCusker and Menard (1985: 338-41); Mitchell, Flanders, Martin, and Carson (1896, 3: 324, 389; 4: 98, 322, 344); Nettels (1934: 8, 11, 13, 20, 59, 79-80, 84-85, 91-94, 99, 120, 126-27, 144-46, 151, 157, 160, 162-78, 202-28, 231-49, 253-55, 276, 279-83); New Jersey Historical Society (1852: 53, 59, 136-37, 167, 221-23); New Jersey, Legislature, General Assembly (1717: 18 {16 January 1716}); Newell (1998: 116, 118, 120, 135, 173); Perkins (1994: 13, 17, 19-23, 26, 51-55, 78); Redish (1984: 713, 727-28); Ricord and Nelson (1885, 9: 135); Wallace and Zhou (1997: 556); Weiss (1970: 773-74); Whitehead (1882, 5: 87-88, 91, 254, 423; 6: 134-35, 137). In addition, the preamble to almost ever colonial paper money law states that specie is scarce.

[2] Specie is a commodity money typically in the form of gold and silver coins issued by a sovereign, but sometimes taken in the form of bullion or plate. Exchange rates between different specie coins is governed roughly by their commodity content. See McCusker (1978). As such, specie readily crosses borders to transact trade between polities with different specie coins.

[3] Nettels (1934: 276).

[4] See Brock (1975: 83, 114-15, 166, 268-69, 286-87, 304-305, 313, 322, 354-55, 362, 386-88, 395, 439, 447, 457, 485-86, 503-504, 523, 529, 536, 561-62); Davis (1964, 1: 34-35, 351, 401-402, 418; 2: 8, 25-26, 32, 49-51, 78, 82, 282, 321-23, 326-30, 379; 3: 235-36, 246, 259-60, 313-14, 341-42; 4: 8, 55-56, 62, 85, 157, 200-201, 380, 387, 391, 400-402, 416-19); Grubb (2006a; 2006b); Kemmerer (1940: 121-22; 1956: 107, 122, 140); Labaree, Oberg, and Willcox (1962, 5: 245; 1970, 14: 77); Lester (1938: 344, 352, 363, 374); McCusker and Menard (1985: 338-41); Nettels (1934: 88-89, 203-205, 207, 249, 280-82); New Jersey Historical Society (1852: 222); Perkins (1994: 18-19, 22-28, 53-55, 81); Redish (1984: 713-14, 727-28); Ricord and Nelson (1885, 9: 407, 412); Rotwein (1970: 69); Wallace and Zhou (1997: 556); Weiss (1970: 773-74, 783).

[5] I apologize for my obsession with fruit in illustrating my heuristic trade/money models. It is the outcome of a brain that dwells too often in a Monty Python world.

[6] On Franklin, see Grubb (2006b; 2006c; 2012); Labaree, Oberg, and Willcox (1959-1998); Morgan (2002); Spiegel (1987); Talbot (2005).

[7] Redish (1984), Redish and Weber (2008), and Wallace and Zhou (1997) explain specie scarcity by the low quality and indivisibility of the coins used. By contrast, the model here assumes that people are smart enough to figure out how to create change and evaluate coins (as embedded in the model's specie transactions cost function). See Davis (1964, 2: 453-54).

[8] The first joint-stock specie-based bank in America was the Bank of North America chartered in 1781 (Hammond 1957).

[9] This model assumes money (M), i.e. assumes that the transaction opportunity cost of M is infinite. No alternatives to M for executing exchanges exist. The non-applicability of this assumption is at the heart of money creation in colonial America. For applications of the quantity theory of money to colonial America, see Grubb (2004); McCallum (1992); Smith (1985a; 1985b; 1988); West (1978); and Wicker (1985).

[10] The amount of bills per white capita in these emissions for Pennsylvania was 1.2 Pennsylvania pounds in 1724 and 2.3 in 1731. For Virginia, it was 2.0 Virginia pounds in 1760. These amounts represent only 4 to 7.5 percent of the yearly income of laborers in Philadelphia (Carter 2006, 5: 652; Grubb 2011: 260-61; 2008; 2016a).

[11] Hume calls bills a "commodity" and called specie "money" (Rotwein 1970: 69). See also Baxter (1965: 14); Brock (1975: 107, 113-14, 120); Davis (1964, 1: 163, 245, 259, 310, 376, 380, 382; 2: 101, 178-79, 193-94, 396, 429; 3: 369-74, 384, 398-99; 4: 100); Labaree, Oberg, and Willcox (1970, 14: 34). I follow this usage, calling all transacting mediums, other than

specie, barter—highlighting the outside versus inside dichotomy in colonial monies. This money-versus-barter language is somewhat arbitrary. All that is needed is terminology that expresses a hierarchy of moneyness.

[12] See footnote 4.

[13] From 1727 to 1733, the Maryland assembly debated passing its first paper money act. In 1728, London merchants wrote to Maryland colonists (*Maryland Gazette*, 15 April 1729) encouraging them to change how trade took place within their colony (Gould 1915: 70). They said, "Indeed, we think it will be the interest of your province, that all debts be contracted in money, it is now time to leave off the old way of barter." On specie being scarce before bills were issued, see Brock (1975: 141-45, 165, 169, 240-41, 350-51, 361, 365, 462, 466, 468, 550); Bush (1977: 301); Davis (1964, 1: 200, 336; 2: 69, 170, 174-76, 237, 307, 396; 3: 94, 198-200, 456); Hening (1819, 6: 467); Kemmerer (1956: 109); Lester (1938: 327-28, 330-38, 346-48, 359; 1939: 184, 208); Mitchell, Flanders, Martin, and Carson (1896, 3: 324, 389); Nettels (1934: 8, 13, 20, 59, 126, 144, 160, 162-78, 202-208, 231-49, 253-55, 280-83); Newell (1998: 120); Whitehead (1882, 5: 87, 91, 254).

[14] See Baxter (1965: 14, 16-38; 2004); Brock (1975: 430-31, 466, 509, 532); Bush (1977: 301); Davis (1964, 1: 113, 204, 400, 435-37; 2: 48, 70-71, 75, 80, 236, 368, 373, 375-76, 453-54; 3: 189, 204, 229, 406-407, 424, 430, 447, 450, 458, 474; 4: 57, 107, 109, 137); Flynn, Karahan, and Schwartz (2018); Hening (1819, 6: 467); Kemmerer (1939: 868-69; 1956: 108-110); Lester (1938: 331-32, 372; 1939: 208); McCusker (1978: 117-18); Nettels (1934: 59, 99, 120, 126, 157, 160, 162-78, 185, 195, 208-28, 250-55); Newell (1998: 118); Perkins (1994: 57-62, 67, 381-82); footnote 9.

[15] A more sophisticated version has $\Delta Mp = -\Delta\varphi EB$ where φ is a continuous nonlinear function with $1 \geq \varphi \geq 0$, with Mp's excess utility value or positive transactions opportunity cost advantage as a medium of exchange over EB declining toward zero as φ declines toward zero. This idea is behind the assertion that increasing Mp increases Y by making transacting more efficient. Given that long-run growth in real output per year per capita was at best 0.5%, it is hard to see room for this effect (Grubb 2004: 351-56; 2016a).

[16] When colonial governments only accepted their own Mp for paying their own taxes, Mp had some excess utility value or positive transactions opportunity cost as a media of exchange in those local economies, see footnote 13. However, given that colonial tax payments were under a few percentage points of colonial income (Rabushka 2008), this effect will be ignored. Fiscal disruptions to accommodate paper money creation are assumed to be small enough and handled credibly enough not to alter Y.

[17] Models of monetary choice are typically complexly abstract constructions of artificial economies, e.g. see Cavalcanti and Wallace (1999a, 1999b); Kiyotaki and Wright (1989); Niehans (1971); Ritter (1995); Starr (2012). By comparison, while using concepts from this literature, the model here is more heuristic, uncomplicated, historically grounded, and so more accessible to an economically educated general reader.

[18] The opportunity cost of specie is the amount the utility value of imported goods exceeds the utility value of domestic goods purchased with the same amount of specie. Money's use as a medium of exchange rather than a store of value is the primary focus. This is relevant when alternative means of executing domestic transactions are present. Economists typically use the interest rate to measure the opportunity cost of money. This application assumes there are no transacting alternatives to money (see footnote 8), thus making money-holding sensitive only to the returns on non-money assets. As late as 1774, colonists held only 2 percent of their wealth in cash, thus making money's asset-holding function less relevant than its medium-of-exchange function (Perkins 1994: 55). If there are no alternatives to specie for executing domestic transactions, or if domestic goods are perfect substitutes for imports, then the medium-of-exchange opportunity cost of using specie is zero, and the opportunity cost to holding specie becomes only the interest rate.

[19] The model requires only that $OC_{sm} > OC_b$ so that "net" $OC_{sm} > 0$.

[20] See footnote 11.

[21] For examples from eighteenth-century writers, see Davis (1964, 1: 113-14, 122, 154-55, 212, 378, 403); Labaree, Oberg, and Willcox (1959, 1: 144-45, 148); and Smith (1937: 22-23, 32).

[22] All that is required is that area (F + G) > area (B + C). This is met by $(OC_{sm} - \psi) \geq [(TC_{eb} - TC_{sm})/2]$ where $\psi > 0$ by some amount depending on the elasticity of demand.

[23] Outside money (specie), when used for domestic transactions, possesses public-good qualities. When treated as a pure private good by individuals the standard under-provision of this public good for domestic use results (i.e. chronic specie scarcity arises).

[24] The move to enhanced efficient barter was delayed in colonies with the most efficient commodity barter systems, namely Maryland and Virginia. These colonies used tobacco as a medium of exchange and unit of account in domestic transactions in an organized colony-wide way. The welfare gains from moving from efficient barter (tobacco money) to enhanced efficient barter (colony-issued paper money) were not as great for these colonies. Therefore, it is not surprising that Maryland and Virginia were two of the last colonies to initiate inside paper money systems. See Hening (1819, 6: 568-69); Grubb (2008).

[25] See Brock (1975: 1, 230, 240-41, 523, 561-62); Davis (1964, 1: 177, 233-34, 357-61, 378, 388, 402, 430; 2: 14-15, 40, 50-51, 155, 282-83, 369, 401, 434; 4: 33, 62, 93); Fisher (1911: 294-95); Labaree, Oberg, and Willcox (1969, 13: 467; 1970, 14: 38, 232; 1972, 16: 2); Lester (1938: 329; 1939: 210, 212); Nettels (1934: 8-9, 46-47, 67-68, 98, 137-41, 151, 158, 280-83).